Concrete

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Profits from Reduced Overruns

Contractors' Earnings Are Severely Reduced by Overruns of Cement and Aggregates — Dwindling Profits May Be Saved by Careful Attention to Measurement of Aggregates, Storage and Handling of Materials, and Greater Care in the Use of Forms

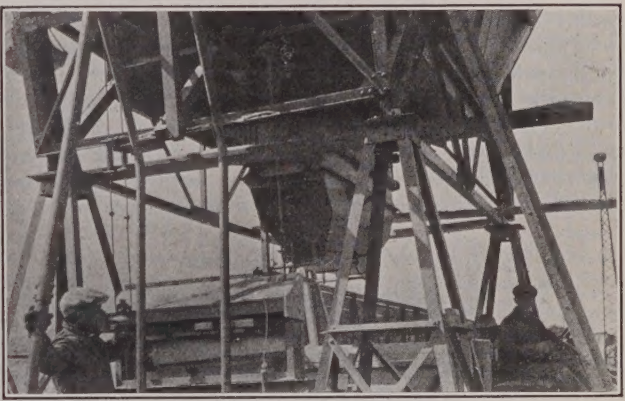
One way to lose money on the job is to use more cement or stone for a cubic yard of concrete than estimated, or more than is required by the specifications. Such losses, coming from inaccurate proportioning, and poor form work, and, on road work, from undue variations in the subgrade and from other sources, can run into a great deal of money on the large job. Unless allowed for, or prevented, they can cause a sizable leak in the contractor's profits, unless the specifications make it possible for the contractor to collect the amounts involved in the form of extras.

Those who have studied the conditions and causes underlying the proposition have come to the realization that it is practically impossible to entirely prevent overrun and underrun of cement and aggregates, when working under the conditions and requirements of the average specification as written today.

In figuring overrun or underrun of materials, the theoretical quantity of each kind necessarily must govern. It is an exception seldom encountered that the specifications make an allowance for overruns, although occasionally, on paving work, allowance is made for an overrun of cement. Contractors often forget to insert in their estimates an allowance to cover overrun of materials, even when experience has taught them the likelihood of such an occurrence. The wise contractor, however, makes due allowance for such losses, and then proceeds to minimize them.

What Causes Overruns?

Overruns are caused, sometimes, by errors or faulty requirements in the specifications, and often in the equipment and the methods used on the job. Specifications are sometimes written in such a way that overrun cannot be avoided. Architects and engineers can be persuaded to write specifications in such a way as to minimize the danger. Otherwise, ambiguities will only make trouble for the contractor.



Weighing the aggregate eliminates losses by affording accurate measurement.

For example, when a specification calls for a 1:2:3½ mix, just what is the mix that is required? Are 2 cubic feet of wet sand, or of dry sand, called for? Does 3½ cubic feet mean mean 3½ cubic feet of coarse aggregate with 30 per cent voids, or with 50 per cent voids? When it is stated that each cubic yard of concrete in place shall contain 1.78 barrels of cement, what limit is placed on the addition or deduction of fine or coarse aggregate to maintain this degree of richness?

When such ambiguities are found in the specifications and a contractor is not permitted to protect himself by applying safe and acceptable methods that will not reduce the quality of the concrete produced, he is due for a loss of materials that will seriously affect his profits. Writing an agreement of cooperation into the contract will often serve to bring about an understanding between the engineer and the contractor, and result in measures that will make it possible to minimize overrun losses.

The minute that a contractor begins a job he should, with the aid of a competent inspector, put measures into use that will reduce overruns as far as possible. It will be necessary to observe and control a number of things on the job. Shipments of materials should be checked for quality and quantity. Materials should be stored so as to protect them from the weather and to prevent losses such as are found in the average stock pile. If great quantities of material are to be stored on the job, their ability to meet specification requirements should be known. Rehandling of aggregates should be minimized, since each rehandling often entails some loss. Aggregate should be measured so as to compensate for the bulking of damp sand, and for variations in the voids of coarse aggregate. Rehandling of cement may be minimized to avoid attendant losses.

Based upon a paper read by Robert E. O'Connor, of J. C. O'Connor & Sons, Contractors, Ft. Wayne, Indiana, before the American Road Builders' Association, at their Chicago convention, Jan. 13, 1926, and upon the observation of the Editors.

Accuracy in cutting and setting forms, together with secure clamping and shoring, reduce loss due to oversize members, sagging beams and slabs, and bulging columns.

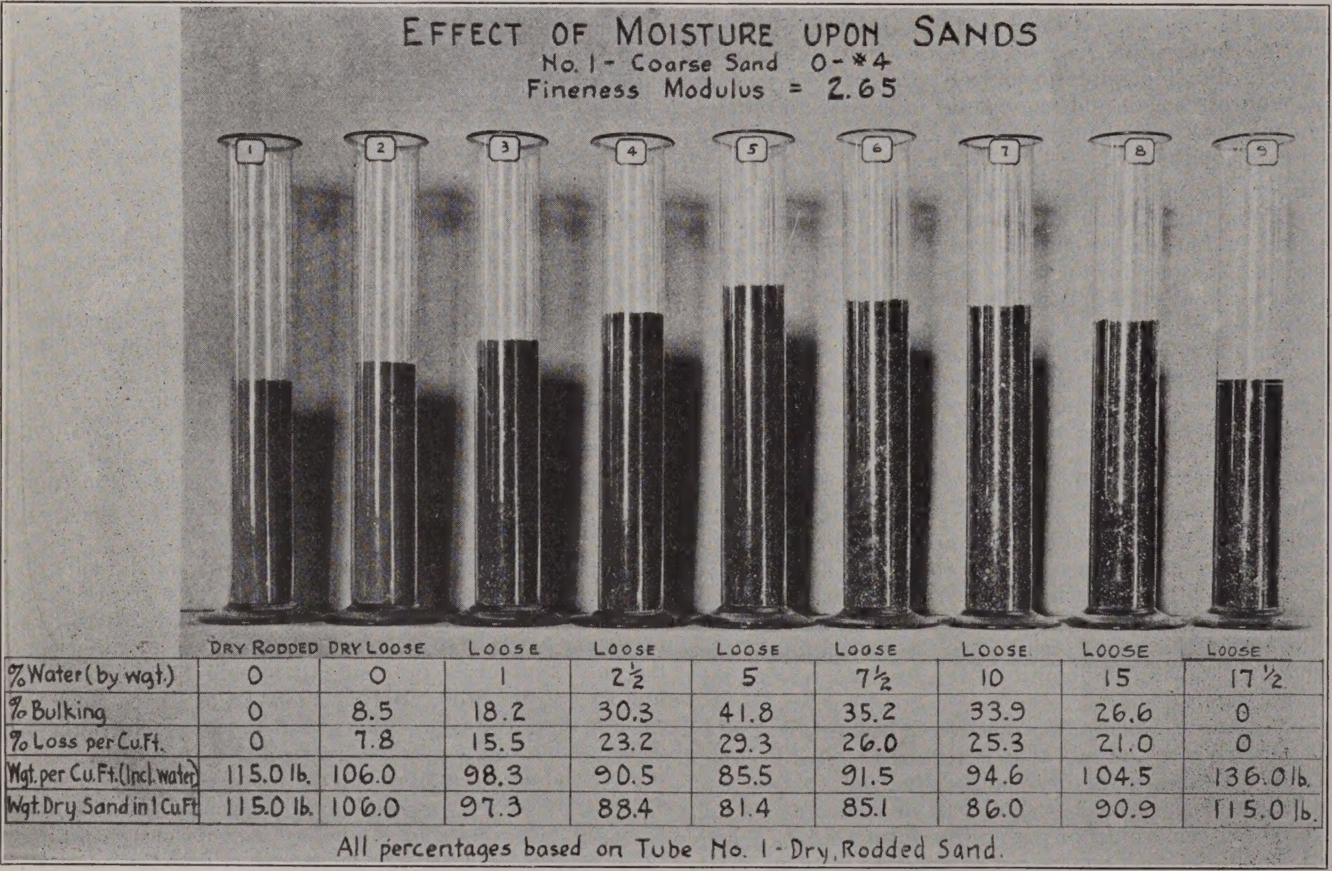
Overruns on highway work are caused by many conditions besides those mentioned above that may apply. Observation will reveal causes of overruns that can be remedied. The subgrade may cause losses due to soil conditions, the weather, and the nature of the section. Points to be watched on the fine grading will include soil conditions, care with which rough grading has been done, the method of setting the forms and the method of resurfacing, operation of the subgrader, requirements for rolling and watering, the cross-section of the finished grade, and the method and specification for testing the subgrade. In mixing and finishing the pavement slab it will be worth while to watch the stability of the side forms, the correctness of the finished template, the consistency of the concrete, the method of finishing, and wastage over the forms.

The Bulking of Sand

As already explained in the pages of this publication, it is a fact that sand bulks when in a damp state. When delivered on the job, torpedo sand will contain moisture, frequently as much as 6 per cent of its own weight. This amount, which is just enough to make sand obviously damp, is sufficient to cause a bulking of 20 to 30 per cent. When measured in the batcher, this sand will therefore not give the same weight per cubic foot as it would when dry. When saturated, the same sand will shrink to about its dry volume. A yard of damp sand, when put into the mixer, would then no longer be a yard of sand, but would be only three-quarters of a yard, and the batch would be just that much short. This shrinkage in the mixer takes place as soon as the cement, coarse aggregates and water are added and the mixing action started.

The effect of this condition on the overrun of cement is important. Take, for instance, a six bag batch of 1:2:3 concrete. This batch would contain, nominally, six bags of cement, 12 cubic feet of sand, and 18 cubic feet of coarse aggregate. The sand, when measured by volume without correction for bulking, will shrink to approximately 9 cubic feet. Instead of placing 36 cubic feet of material into the drum for each batch, there will be only 33 cubic feet present. The loss in yield with such a batch is then about 8 per cent. A six bag batch of 1:2:3 concrete should build 2.266 lineal feet of 18 foot concrete road 7 inches thick. With the loss in yield due to the above bulking, only 2.075 lineal feet of slab can be constructed. Theoretically, there would be 2,331 batches required to construct a mile of pavement, but with the shrinkage loss mentioned above, 2,545 batches will be needed. Thus, if no allowance is made for bulking, the contract will require 321 more barrels of cement per mile than estimated, and 142 more cubic yards of coarse aggregate. The amount of sand saved will amount to about 187 cubic yards. The net loss to the contractor, in material cost alone, with cement at $2.10 and aggregates at $2.50, would amount to $561.60 a mile. The total loss would include the labor, equipment and other charges for the excessive batches, plus the above extra cost of materials.

It is easy to see that the bulking action must be corrected, if true economy is to result. There are three ways to do this. The first is to apply the necessary correction on the batchers, using constant laboratory tests as a guide. The second is to make use of a weighing batcher, or other form of scales. The third method is by inundation.



	DRY RODDED	DRY LOOSE	LOOSE	LOOSE	LOOSE	LOOSE	LOOSE	LOOSE	LOOSE
% Water (by wgt.)	0	0	1	2½	5	7½	10	15	17½
% Bulking	0	8.5	18.2	30.3	41.8	35.2	33.9	26.6	0
% Loss per Cu.Ft.	0	7.8	15.5	23.2	29.3	26.0	25.3	21.0	0
Wgt. per Cu.Ft. (Incl. water)	115.0 lb.	106.0	98.3	90.5	85.5	91.5	94.6	104.5	136.0 lb.
Wgt. Dry Sand in 1 Cu.Ft.	115.0 lb.	106.0	97.3	88.4	81.4	85.1	86.0	90.9	115.0 lb.

All percentages based on Tube No. 1 - Dry, Rodded Sand.

Just a laboratory demonstration to show the contractor what happens to the sand on the job. Each tube contains the same amount of sand as every other tube, but the moisture causes it to take up more space. A common cause of overruns.

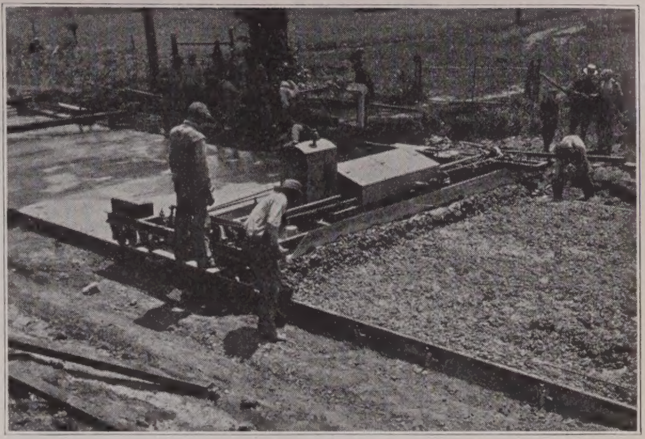
The volume corrections on the ordinary batcher, to be of any real service, must be based upon calculation or tests that are not very easy to apply on the job. Since the moisture content varies slightly, with an attendant more pronounced variation in bulking, from day to day, this first method is ordinarily not used except for rule-of-thumb corrections that are not to be relied upon for real accuracy. The process of weighing the sand is used by many contractors, and is required on highway work in several states. Minor variations, due to the actual weight of the moisture in the sand, may be compensated for after making moisture determinations that can easily be handled on the job. The amount of moisture in the sand should be known, in order that the proper corrections may be made on the water tank of the mixer and in order that the scales may be adjusted to account for this difference in weight. The principle of inundation has been made known quite generally, and a number of contractors are using that type of equipment with satisfaction. Inundating the sand shrinks it to its dry volume and at the same time makes an exact allowance for the water content of material.

Measuring Coarse Aggregates

Correct measurement of the coarse aggregate has been well taken care of by the equipment manufacturers. Practically all the trouble that has been encountered has been due, it is said, to the grading methods used by the aggregate producer, and because of careless handling methods on the job. The variation of grading of coarse aggregate has an effect on the yield. If the cement factor allowed for in the estimate is based upon a normal grading of coarse aggregate from ¼ in. to 2½ in., and the grading changes so that nearly all the material below ¾ in. is omitted, the reduction of yield will be approximately 4 per cent.

In actual costs this means about one-half of the overrun of materials mentioned under bulking of sand. Not being aware of these facts, many contractors have been lax in their attention to the materials delivered to them for use in making their concrete, especially when it comes to the coarse aggregate. Even though the coarse aggregates might meet the requirements of the specifications while at the material yard, or still in the truck or car, yet, by the time they are unloaded at the job and handled from once to several times before getting to the mixer, it is often the case that the original grading has become destroyed through segregation and even by loss of various amounts of the different sizes, until the contractor no longer obtains the expected grade at the mixer. Reduction of rehandling, the use of overhead bins instead of stock piles, facilities for regrading, or other well-known measures, can be taken to compensate for the changed gradings and assure aggregate that will afford the desired yield. So serious is this situation that the highway department of a leading state estimated that 50 per cent of the coarse aggregates reaching the mixer, on the highway projects under its supervision, were deficient in fines.

The soil conditions, weather, and the skill used in grading are all important considerations affecting cement overrun on paving work. Wet weather not only slows up operations, but it actually leads to overruns and underruns, to some degree, depending upon soil conditions, method of delivery of batches to the mixer, the season of the year, and so on. If, on certain soils, trucking is done over the subgrade, the only sure way to prevent overruns or underruns, is to stop placing concrete until better conditions exist. Damage to the subgrade can sometimes be minimized by laying planks thereon to carry the traffic. Careful attention to rough grading, so that forms will not be carried on fills and so that final grading will be done by light cutting, will create conditions that will help minimize overruns.



Careful operation of the finisher stops lost concrete due to spillage on the forms.

Good Formwork Needed

On buildings it is especially important that the forms be made and fitted accurately and that they be securely braced. Even on highways does the matter of forms have a bearing on the prevention of overruns.

Too often the contractor thinks it real economy to use cheap form lumber, set it up to approximate dimensions, and use clamps and shoring in such a way that the newly placed concrete will cause spreading and sagging, and require the placing of much more concrete than required by the plans. The overruns on a sizable job not only cost the contractor money that should have been counted as profits, but he must usually spend even more money to bring the girder, beams, columns, and slabs to approximate size and line. When plastering may be resorted to, this is not as serious a matter as when cut stone or other trim must be attached to the concrete. In the latter case a great amount of grinding, cutting or rubbing will frequently have to be done. The money lost because of overruns and expenditures for hand finishing will frequently exceed greatly the cost of more secure forms.

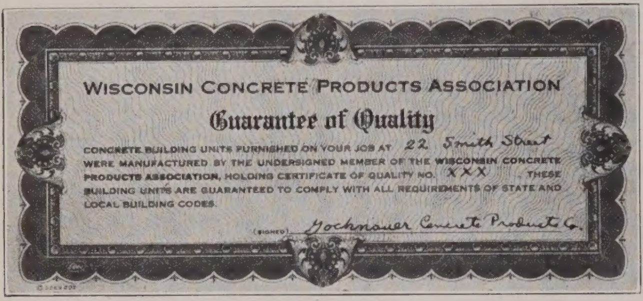
On paving work the forms must first be selected according to the soil conditions found on the job. A form that will be good on one soil may prove useless on another. Each section must be strong enough to take loads and impacts of the subgrader and finishing equipment without deflection or distortion, and the area of the base of the form must be large enough to carry the required loads on the particular soil encountered. Sidethrust of the equipment and the lateral thrust of the concrete have to be withstood. Staking arrangements must be made to help keep the forms in place, together with locking devices that will keep the joints securely in line. Forms should be set carefully to line and slightly above grade before the subgrading operation. Careless formwork often leads to excessive slab thickness and width, and thus causes further overruns of materials. Subgrading should be left uniformly slightly high, so that the final cuts may be easily and accurately made with the drag template. Low spots are to be avoided, as filling is not generally permitted, and excess concrete will therefore have to be placed.

The final point at which corrections may be made is at the mixer. Care should be taken that mixes are as workable as possible, for otherwise the finishing machine will waste some of the material over the sides of the forms, or even ride a little high, and thus increase the thickness of the slab a fraction of an inch. These leaks in the contractors' profits are easily stopped if caught in time.

Selling Block for Factory Construction

How Concrete Block Have Become the Standard Building Material for Industrial Buildings, as Well as Homes, in a Wisconsin City—An Outline of the Merchandising Methods Used by a Leading Producer to Accomplish This Result

The Gochnauer Concrete Products Company is located in Appleton, Wisconsin, which has a local population of 25,000 and a total population of over 100,000 within a ten mile radius. Appleton is a manufacturing town in that great paper and pulp district of the Fox River Valley. The principal things manufactured there are paper and pulp, paper specialties, machinery for paper mills, paper mill wires, machinery for the farm, dairy products, lumber and the like.



WISCONSIN CONCRETE PRODUCTS ASSOCIATION

Guarantee of Quality

CONCRETE BUILDING UNITS FURNISHED ON YOUR JOB AT 22 Smith Street WERE MANUFACTURED BY THE UNDERSIGNED MEMBER OF THE WISCONSIN CONCRETE PRODUCTS ASSOCIATION, HOLDING CERTIFICATE OF QUALITY NO. XXX. THESE BUILDING UNITS ARE GUARANTEED TO COMPLY WITH ALL REQUIREMENTS OF STATE AND LOCAL BUILDING CODES.

(SIGNED) Gochnauer Concrete Products Co.

This is a reproduction of the Guarantee of Quality given to every customer when the job is completed.

While in many cities the construction of garages of concrete block, and maybe a store or two, are common; in Appleton and vicinity, of late years, any factory, warehouse, store or garage built of material other than concrete blocks is the exception. The largest factory so constructed is that of the Tuttle Press Company. This factory, two stories high, covers an entire city square. The president of the company, Mr. Tuttle, lives in a concrete masonry house and keeps his cars in a concrete masonry garage.

The Appleton Coated Paper Company, which makes coated paper for all high class printing, has a considerable portion of its mill constructed of concrete masonry. The Wisconsin Wire Works, making paper mill wires which sell from coast to coast, is built entirely of concrete masonry. The Eagle Manufacturing Company, makers of farm machinery and tractors; the Rowell Babbitt Works; the Valley Iron Works, makers of paper mill machinery; the Appleton Press; Woelz Brothers Paper Company; Hayton Pump and Blower Company; and many other factories are of the same construction. Three and even four story warehouses, milk products companies, oil stations, public garages, stores galore, school houses, and the like have walls of concrete masonry.

It is hard to figure out any one outstanding feature as responsible for these sales unless it is quality. Mr. Gochnauer has always been very careful of the quality of his product. Then, too, his organization is thoroughly sold on the material and has a deep-seated belief in it as a construction material, fit for any purpose.

Selling the Architect

There are, perhaps, five important people to reach in selling material for factory construction. First and most important is the architect or engineer. Sales efforts used by Mr. Gochnauer do not depend primarily upon sales for a certain job, but are more of an educational nature. The engineer or architect, being of technical mind, can grasp the results of tests, and is kept informed on the results of each of the tests made on the products from the plant. Tests on one size of block only are not enough, but they have tests made on 8″ and 10″ and 12″ wide blocks so that the engineer may know definitely just what each size is good for. These tests are compared with tests of other materials.

It is surprising to see the interest of the architect in a material if he is told all about it. He is invited to visit the plant and is taken through it and shown the qualities of the materials used; he is shown, that due to the methods of manufacture, the products are bound to be of uniform high quality; then he is shown the stock in the yard—how uniform it is, how quickly it dries out after wetting. He is kept informed, also, as to progress in the industry. For instance, when the new book on portland cement stucco was published by the Portland Cement Association. Mr. Gochnauer wrote each engineer and architect telling him of the book and that the Portland Cement Association had been asked to send him a copy as soon as it was off the press. The architect was told that if he did not receive his copy in a reasonable length of time to notify the concern and they would make sure that he got a copy. As a result of this educational work with the architect, concrete block are given fair consideration in any project that comes up.

Working with Owners

The next person of importance in selling material for factory construction is the owner. Mr. Gochnauer works on the theory that every going business is a prospect. By personal letter, the heads of industries are kept informed as to the value of the product for any addition or new building they may contemplate building. But how to make sure that the busy executive, the prospective customer, reads the letter? It is made so attractive that he must read it. The products man is told to get the prospect to recognize him, not as a dabbler in mud, but as an important citizen of the community. When the products man is called by his first name at Rotary club or the Chamber of Commerce meeting, it is a sure bet that the prospect will take time to read whatever is written to him, and it will have more weight. But that point of contact must be used with discretion, as it can be easily overdone.

The next person, the third on the list of contract, is the

Summary of C. O. Gochnauer's own story of how it was done, as told by him at the recent convention of the Concrete Products Association, in Chicago.

contractor. He also must be favorable to concrete masonry. Just who may be on a given job is not known, so the effort is to create a favorable impression not only with every contractor in the vicinity, but also by personal letter. Not one, but many. One is more apt to get game with a scatter gun than with a single shot rifle. He is working on the mason contractor now, with the idea of increasing the building of concrete masonry house, covered with portland cement stucco. Besides bringing out the good points of this type of construction he speaks in that idea of personal gain, in that it will greatly increase the contractors' field of work. Why should he build only the foundation and the chimney, and plaster the house, and leave all of the rest for the carpenter contractor. This idea is even carried to the individual masons.

Then fourth on the list comes the banker. Very often it is necessary for the owner to borrow money to carry on the work. It is necessary, then, that the banker should be informed as to the true worth of concrete masonry construction so that he will not hold up the loan. This, too, is done by personal letter.

Getting Official Approval

Fifth and last on the list are the state and local building inspectors. These men are kept informed as to just what is being done in the plant. This may seem strange, but it works out well. Not long ago, last year, in fact, a local architect made a hurried trip to Madison to get the approval of the Building Division of the Industrial Commission on plans for a building of concrete masonry about to be erected. He called on one of the assistants who looked over the plans and specifications. "Whose block are you going to use?" was the query. The architect replied "Gochnauer's." "Well, why don't you write it in, then?" The architect, conferring with that producer a couple of days later about some specials, told of it, saying, "How do you fellows get in cahoots with the Industrial Commission? What do you give them?" Consistently good quality products, together with real co-operation is the answer. Another incident—the state building inspector was calling on the local building inspector. A man came in who was going to build a store. Someone had put a bug in his head that concrete block were no good. "Whose block are you going to use?" asked the district inspector. "Gochnauer's" was the reply. "You couldn't use a better building material than Gochnauer's block," replied the inspector and the job was sold. Worth a letter or two, wasn't it?

Direct mail advertising and personal work is the best method for sales of materials for this class of structure,

Two of the newspaper advertisements, reprints of which are used as stuffers, constantly used, by the Gochnauer Concrete Products Company.

FIRE! FIRE! FIRE!

Will Concrete Blocks Burn, Crumble or Disintegrate?

For two years past the UNDERWRITER LABORATORIES have conducted severe fire tests on Concrete Block Walls.

These tests have been much more severe than could be obtained in any actual fire. In none of the many tests made did fire penetrate the walls or did the blocks crumble or disintegrate, in fact with 2000° of heat on one side of the walls it was 3 hours before the unexposed side became hot enough to set paper, that might be in contact with it, on fire.

The Underwriters Laboratories recommend a 2 hour fire rating on Concrete Blocks made of materials and methods as are employed in the manufacture of

Gochnauer's Concrete Products

HIGH TEST BLOCKS

FIRE LOSSES in the United States

1 Farm Building Fire Every 7 Minutes

1 Dwelling Fire Every 3 Minutes

Sixteen ($16) Dollars Loss Every Second.

Forty-One (41) People Burned to Death Every 24 Hours.

Forty-Seven (47) People Seriously Injured Every 24 Hours.

Sixty Thousand ($60,000) Dollars Loss Every Hour, Night and Day.

Fifteen Thousand (15,000) People, Per Year, Burned to Death.

Enough Buildings Burned Yearly to Make Solid Row from New York to Denver.

Would Take One Thousand (1,000) Tons of Gold to Pay Yearly Loss.

Yearly Loss is Twice the Interest on All Savings Bank Accounts.

Would Build 100,000 Dwellings Costing $5,000 Each.

Amounts to $4.75 for Every Man, Woman and Child in the Union.

Concrete Masonry is Fireproof

GOCHNAUER'S

believes Mr. Gochnauer. Linked with this, however, he carries on a newspaper advertising campaign. This, too, is mostly educational in nature. Reprints are made of the feature ads, such as the one on results of the Underwriters' Laboratories fire tests, and these are used as stuffers in all mail. Uncle Sam thus renders full service for his two cents by their enclosing a stuffer in every letter, statement or receipt that is sent out. It costs little or nothing and carries on the general educational work.

Results of Advertising

The architect has been sold, and specifies concrete masonry construction. The owner, after discussing comparative values with the architect, is also sold. The contractor, called into conference, has no objection to block, in fact, rather favors them. The banker is willing to advance the money and the local and state inspectors have given their approval to the plans. Often Gochnauer's block are specified, but in any case suppose he has landed the job. Does he sit back and when the order to start hauling comes in, send some corners and stretchers and fittings? Hardly. Now is the best time to thoroughly sell that architect and that owner and that contractor, he claims. As soon as a job is secured, he gets a copy of the plans, draws detailed block plans with special details for any special work, such as pilasters, jamb block, joist block and the like. He gets those specials made and cured. There is no cutting on that job. Things are made to fit that block plan. When work is about to start, the block are put on the job thoroughly cured, and piled so that all fittings are accessible. No block is taken to the job until shortly before the time for it to be used, but every block is there when needed. There is no delay—no waiting.

Real Job Service

He is also on the job to assist the mason in laying out any special feature. He does not sell block, but the completed job. Nor does he get paid by the block, but by the square foot of wall. He may get paid only for furnishing the block, but believing that his products are judged, not by themselves, but by the finished job, he does everything in his power to make that finished job worthy of his products. As one mason contractor has said, "You can give the job to Gochnauer, tell him the time you want to start, and forget all about the block end of the job until time to pay up." The contractor makes money on the job and is sold. The owner and architect, satisfied with the completed building, are sold. In his estimation this feature of the service, together with the quality of the material, do more to account for the number of "above grade" jobs in this vicinity than all the others combined.

When the job is completed, the owner is sent one of the certificates of the Wisconsin Concrete Products Association to be filed away as evidence that the block used in that building were approved by the Industrial Commission of the State.

Mr. Gochnauer not only believes that producers are judged by their own completed buildings but that they are also judged by the completed building where other materials than their own are used. Any poor block job reflects discredit on every producer. This is the way he handles that situation. When he hears of any proposed concrete masonry job in his vicinity he immediately notifies the State Building Engineer. He does this before the contract is let. He, in turn, notifies the owner that only state-approved blocks can be used on that job. Then before construction starts, no matter who has the job, the state building inspector in the district is told of the work. He is therefore able to get on the job at the start and to see that the state requirements are carried out. Mr. Gochnauer especially likes to have this state inspector visit his own jobs to check up on the mortar used. It is just as important that good mortar is used, he says, as it is that a good product be used, or even more so.

California Adopts Steel Forms for Expansion Joints

By MICHAEL J. PHILLIPS

As the result of experiments by California State Highway Commission engineers, all expansion joints in concrete highways built by that state will hereafter be made by a new method, in which metal plates, instead of wooden header boards, will be used. The boards have not been satisfactory, for two reasons; they are difficult to remove from between the concrete slabs; and their removal, while the concrete is soft, sometimes results in damage to the end of the slabs. Also, they frequently resulted in severe impact by traffic.

The boards used to make a joint an inch and a half wide were slightly wedge shaped, with the thin edge at the bottom. This was to facilitate removal. The new type of header consists of $\frac{3}{4}$-inch metal plates, cut to conform with the proposed cross-section of the pavement, and held together by six small clips. The outside plates are in halves, the centers one in three parts so that, when assembled, the middle section of the center plate laps the joints in the outside plates, making the header rigid.

The assembled header is held in place temporarily with stakes, while the concrete is being poured, tamped and finished in the usual manner. The concrete is edged on both sides of the header and when the pavement is set the header is easily removed. No difficulty is experienced, nor is the pavement damaged.

The center section is pulled out first by means of notches, to which hooks are applied. This section is oiled before being placed in position. When it is slipped upward, the outside sections fall together, and are in turn lifted out.

Joints constructed with the metal header have a uniform width extending from the surface to the subgrade. This uniformity was impossible to attain with the old wedge-shaped board arrangement. The latter will soon be entirely supplanted on California state highway concrete work by the metal contrivance.

Did you know that concrete, like a broken leg, will heal up and be as good as ever, or even better, if it is given half a chance? Just because you get a little contraction crack in that face block, tile, or trimstone, don't throw it away. You are losing material and labor that cost money. Just have a little bin of wet sand off in a corner of the plant where you can bury the cripples for a few weeks or months. There they can be kept moist until the healing has taken place, and are often then found fit for the job. A similar stunt works well on *in situ* concrete. A little wet sand and a supply of sacking, plus frequent attention with the hose, will sometimes redeem a job that would otherwise have gone bad. It's worth trying.

When a customer says that a concrete house is "cold and damp" just ask him why the builder furs out the lath and plaster on the interior of a brick wall or a wall of other masonry. You can easily show him that a furred concrete wall is as warm and dry as a furred brick or tile wall, and that an unfurred concrete wall is no colder or damper than an unfurred wall of other masonry. A double wall, or a wall containing a good system of air spaces, often makes furring unnecessary.

Block Men Protest Insurance Rates

In Most Cities Concrete Masonry Pays the Same Insurance Rate as Frame—The Products Manufacturer Is Now Demanding That This Penalty Be Removed and That Concrete Masonry Be Given the Same Rates as Other Fire-Safe Construction

Attention is being called, throughout the country, to the obvious discriminations against concrete masonry construction in the classifications of the various fire insurance rate-making organizations. In most cases it has been observed that this type of construction, not long ago given a 2-hour fire rating by the Underwriters' Laboratories, is still classed with frame construction and is made to pay the same penalties. Since this higher rate of insurance often works to cause owners to select other materials, and tends to curtail the market of every producer of concrete units, it is becoming realized that it is now very important that the industry take steps to remedy the situation. At present, the Concrete Products Association, and the various state products organizations, are taking steps toward the solution of the difficulty. These organizations are not requesting special consideration for concrete masonry construction, but are merely asking, and working, for a reclassification that will be more in line with the merits of the material. It is the desire and the need of the industry that concrete block and tile be removed from the frame classification and given the same classification as clay brick.

Hard Job Ahead

It is a difficult situation that the products industry is facing, but it is no more difficult than the building code situation that has been more or less satisfactorily met in a number of states and cities. The growing success in the latter work bears promise of equal success in the newer and equally important movement.

Fire insurance is provided mostly by stock or mutual companies, and it is their responsibility to distribute the fire burden of their policyholders as fairly as possible. Since the insurance companies are in business to make money, it is of course necessary that the insurance be written at rates which cover the costs of doing business and the losses, and also pay a fair return on the money invested. Revenues collected must be sufficient for the purpose. It is considered to be to the interests of everyone that the rates on the various classes of structures should be arranged as nearly as possible in proportion to the cost of doing business upon each class. In other words the rates are supposed to be based upon the relative fire hazards of the various types of construction. Most generally this theory is carried out, and it is acknowledged as the correct principle. Yet there is the one exception to the rule, the classification that couples concrete masonry with frame construction.

Since most state laws require the insurance companies to maintain a bureau to study and fix its rates, or else have this work done by an outside organization, and since the former requirements would prove too heavy a burden on the individual companies, there have come into being a number of rate-making bureaus. Rate fixing power, as a result, is now in the hands of some 60 independent rating bureaus, each controlling the rates within a prescribed territory. No national board or organization has supervising or reviewing power. These bureaus, of course, are subject to various state laws, some of which seem to give them free rein, while others quite evidently impose upon them restrictions that are considered rather extreme. These bureaus are, in effect, joint organizations of the various fire insurance companies.

One Interesting Example

In computing rates on various structures these bureaus are supposed to give due consideration to fire loss records and to available scientific data, and upon such information base rates that will be strictly in accordance with the actual hazards involved. While most rates may be thus correctly made, it is seen that no such accuracy has been used when it came to concrete masonry. Take for instance page 3 of the Dwelling House Schedule of Fire Insurance Rates issued by the Ohio Inspection Bureau. It reads:

> *Brick Buildings.* Classification to include brick, hollow-concrete block with brick facing, hollow tile, terra cotta, solid concrete block, stone and reinforced concrete construction.
>
> *Frame Buildings.* Classification to include frame, iron-sheathed frame, brick-veneered, hollow-concrete block without brick facing and plaster on wood and metallic lath on wood studding construction.

Similar provisions have been made by other rate-making organizations, although some progress has been made recently in getting a few bureaus to take cognizance of the Underwriters' Laboratories tests. For instance, the Tennessee Inspection Bureau has issued a new dwelling schedule, revised to March 1, 1925, in which hollow concrete masonry dwellings are given the same fire insurance rates as those built of brick, stone and hollow clay tile. The Underwriters' Association of the District of Columbia gives hollow concrete masonry the same rating as brick. Likewise, in New Jersey, the Schedule Rating office of that state grants hollow concrete masonry the same rate as brick for private dwellings not exceeding two families and not exceeding a value of $50,000 in building and contents. The Southeastern Underwriters' Association, covering seven states, has in the past applied wood frame ratings to hollow concrete block, but the rates are now being adjusted so that in both the dwelling and the mercantile schedules the penalty for unapproved block will be half the penalty for wood frame, and for approved block the penalty will be one-fourth that for wood frame. At the present time the Underwriters will not approve concrete tile with an average face shell thickness of less than 1¾ inches and a minimum of 1½ inches, with a tolerance of one-fourth inch.

Mercantile Building Schedules

The Dean Analytic System, sponsored by the Western Actuarial Bureau, is used in 20 states, and rates hollow

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Data used in preparing this article was taken from a paper read by A. J. R. Curtis, at the Concrete Products Association Convention, in Chicago, and from a paper read by Norman M. Stineman, at the Ohio Concrete Products Association Convention, in Toledo. To these men we are indebted for the interesting information published herein.

concrete masonry in buildings of the mercantile class as follows:

> The basis-rates are founded on brick exterior wall construction. The penalty for hollow concrete masonry in exterior bearing walls is 36 percent on Class "A" buildings and 44 percent on Class "B" buildings. However, hollow concrete masonry obtains the same rate as hollow brick when faced on both sides with four inches of brick, or on one side with eight inches of brick. This, of course, is impractical construction.

The following further modifications are made in buildings having structural frames of reinforced concrete or of fireproofed structural steel:

1. The panel wall or curtain wall penalty is reduced one-half.
2. The panel wall or curtain wall penalty is waived when block are faced with four inches of brick or its equivalent.
3. No penalty is added for hollow concrete masonry for interior walls except fire wall, stair walls, and similar uses. This means that hollow concrete masonry can be used in practically all interior nonbearing partitions in mercantile buildings without penalty.

The foregoing means that wherever the Dean Analytic System is used, hollow concrete back-up block or tile, if faced with four inches of brick or its equivalent, can be used in the panel walls and curtain walls of building of skeleton construction, without penalty. They are restricted from use in fire walls, stair wells, elevator shafts, and so on. This affords a partial market. In buildings of over five or six stories, however, the weight of most concrete units will forbid their use, and the market in effect will be open only to units made of cinders and other lightweight aggregates. In some kinds of structures, such as large warehouses, the interior wall surfaces are left undecorated. Since that is the case, the architect will generally insist on all walls, exterior and interior, being built of the same materials, for the sake of appearance. When concrete masonry may be permitted in one wall of the building and not in another, in effect the concrete masonry is prohibited from being used at all, in such a structure. That is another point worth attention.

High Fire Rating Given

Mention has been made of the recommendation of the Underwriters' Laboratories on the matter of the fire-resistance and classification of hollow concrete masonry. That organization, tested, some time ago, a number of specimen walls built of hollow concrete masonry. The standard fire, hose, and impact tests were made, and as a result it was announced that a good hollow concrete masonry wall could be given a two hour fire rating, and that such a wall stuccoed with Portland cement stucco could be given a rating of 2½ hours. In detail, the Underwriters' Laboratories made the following recommendations:

> "We recommend promulgation of the following Special Information cards applying to Exterior Walls and to Interior Walls, Partitions, and Vertical Shaft Enclosures built up of Hollow Concrete Building Units. Guide 40 UC 24.4. May 1, 1924—Laboratories File R 1555.
>
> SPECIAL INFORMATION CARD
>
> "Exterior Walls of Hollow Concrete Building Units. 8-in. Exterior Walls, conforming to usual limitations as to loads, heights, and unbraced areas, built up of Standard hollow Portland cement concrete building units with Portland cement mortar are shown by standard Fire Endurance, Fire Hose Stream, Impact, Compression and other tests to furnish protection against passage of flame, and dangerous temperature for the periods given in the following classifications.
>
> "The hollow units are subject to end shell and web cracking early in the fire exposure period. This cracking impairs the stability of loaded walls and of other walls of excess height and areas.
>
> Non-Load bearing panel enclosures and curtain walls ....R 2 hr.
> Loaded Walls ....R 2 hr.
>
> *See text in regard to stability and framed-in members.*
>
> A finish on the exposed side of Portland cement stucco, ¾ in. thick, will usually furnish one-half hr. additional protection. The use of framed-in combustible load bearing members will reduce the period of effective protection at least one-half. See cards following Guide No. 40 UM 2.5 for manufacturers of Standard Hollow Concrete Building Units."

(The same recommendations are made for interior walls and partitions.)

Various manufacturing processes were used in making the concrete block and tile for the tests. The report says:

> ". . . The data secured from the fire endurance tests does not warrant preference as to form or design of block."

In other words, these recommendations apply generally and are not restricted to any special manufacturing methods.

The reports supporting these recommendations very definitely prove the satisfactory fire retardent value of concrete masonry. Attached to the report just referred to is an appendix presenting the results of tests on the stability of masonry walls by the Department of Scientific and Industrial Research of the British Government. These tests conclusively indicate that concrete masonry walls have about twice the resistance to lateral pull as do clay brick walls. This indicates that the observed web cracking referred to in the report is of little significance. These cracks, which are generally not to be found except by striking the block briskly with a hammer or pick, are vertical in general direction, but are so irregular that the construction is in most cases still well-keyed together.

The Salvage Question

Lack of salvage value is often advanced as argument against lower rates on concrete masonry, but that argument is easily controverted by the evidence available. It is sufficient, here, but to state that the estimated salvage on a brick structure, according to the actuaries themselves, is as low as three percent of the cost of the building. This figure, based as it is upon the use of the obsolete lime mortar so easily removed from old brick, is rather high for present construction. The greater difficulty of removing cement mortar would lower this salvage value to a great extent, it is believed. Again, it has been observed, the brick rates are often applied to hollow clay tile, which admittedly has no salvage value at all.

With the array of facts that can be brought to bear in favor of a lower rate on hollow concrete masonry, together with the inspection and label service soon to be put into operation by the Underwriters' Laboratories, it is difficult to see why no action has yet been taken by some of the rate making organizations.

The National Movement

The products industry is taking steps toward a satisfactory adjustment of the present erroneous classifications. This has been given an important place on the program for the activities of the current year.

Because of the geographical nature of the situation it has been found advisable for the work to be carried on to a great extent by each state association and the active members of each association, with the constant aid and coordinative efforts of the national organization. Individual insurance agents are being asked, at every opportunity, to take up the matter with their home offices. The insurance companies themselves are being approached. Manufacturers are visiting the officials of the rate-fixing organizations in their respective territories and the facts are being laid before them. The public is being shown that the concrete masonry building is firesafe and permanent. Bankers are being convinced that an investment in such a structure is the best sort of real estate investment that could be made.

Every products manufacturer who realizes the need for the removal of the current restrictions that are so curtailing his markets is giving his wholehearted support to his industry in the movement.

Little Hand Labor in Gibraltar Plant

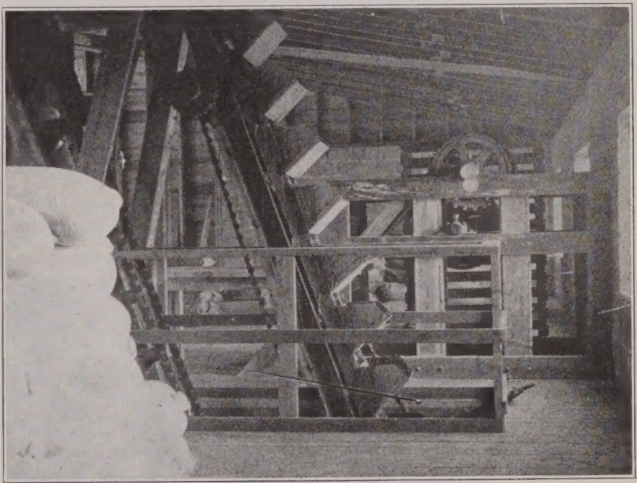
Indianapolis Block and Tile Producer Lets Power and Gravity Do Most of the Work in His Three-Story Plant—Rack Cars Transport the Block—Transfer Car Aids in Unloading the Kilns

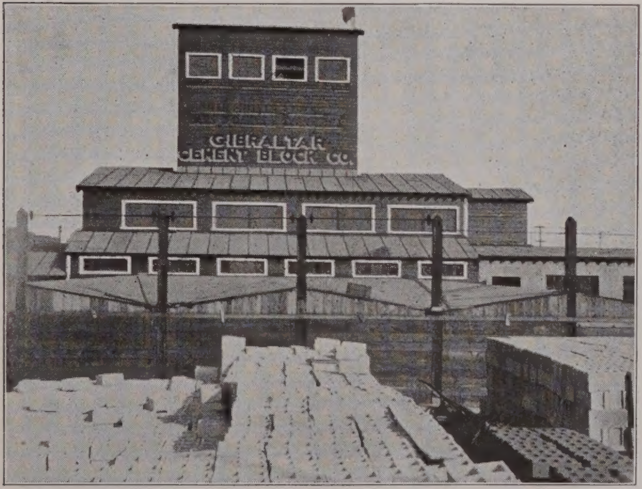
The Gibraltar Cement Block Company, of Indianapolis, Indiana, operates a plant that should prove interesting to the devotee of mechanical handling of materials coupled with the use of gravity. John G. Praed, the president of the concern, originally operated a small plant on the premises of a large gravel company, but when forced to expand to meet a growing business, the plant had to be moved away from the source of aggregates.

The present plant, a great deal larger than the original one, is laid out for unusual efficiency. Aggregates are loaded into an overhead bin by means of a bucket conveyor arranged to provide for either car or truck delivery. The bin holds a large supply of gravel, sufficient to last for some time. Cement, in sacks, is likewise elevated to storage by means of a belt conveyor.

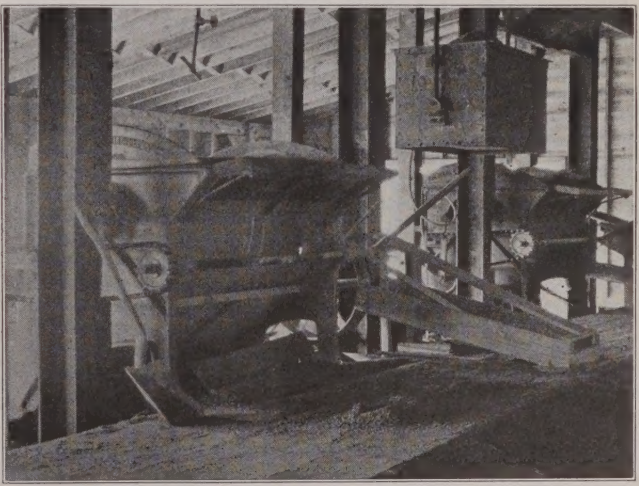
On the mixing floor, directly beneath the aggregate storage, three Ideal mixers are installed. These three machines are operated by one man, who is able to mix enough concrete to keep the entire plant in operation. The cement is stored on this mixer floor. The gravel is fed from the bins through measuring hoppers into a bucket traveling on an overhead monorail. This bucket handles sufficient aggregates for a complete batch, and discharges into any one of the three 9 cubic feet mixers. The cement is put into the mixers by hand.

On the ground floor of the plant are found the 2 Universal block machines and the Ideal roll-over stripper. The latter is equipped for making both block and tile, while the Universal machines are only used in the manufacture of block. The mixers feed these three machines by means


Part of the mixer floor, with the gravel conveyor passing through to the storage bins, and the head end of the cement sack conveyor in the background. Sacks of cement are to be observed, awaiting use



View of the plant, kilns, and stockpile, with a loaded car of block just being pushed away from the transfer car. The building is a combination of concrete masonry and frame

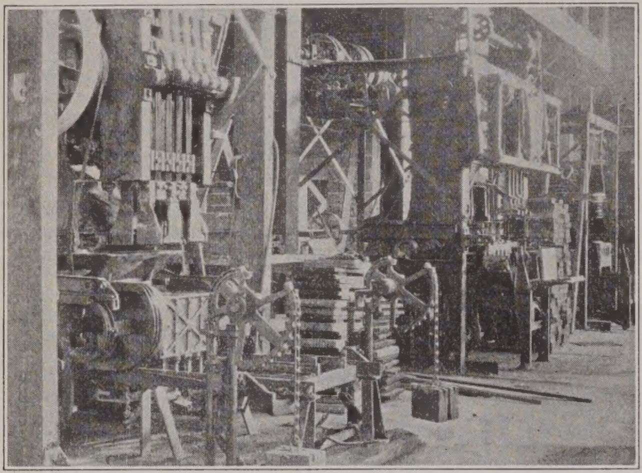

Another view of the mixing floor, with two of the mixers and a bucket of gravel, on the monorail, coming up to feed one of the mixers. Notice the home-made belt guard protecting the belt that drives the mixer in the foreground

of hoppers, thus receiving a constant supply of concrete in a sufficient quantity to keep them in constant operation. The block machines are the two originally installed in the first plant, while the roll-over stripper was purchased when the new plant was installed.

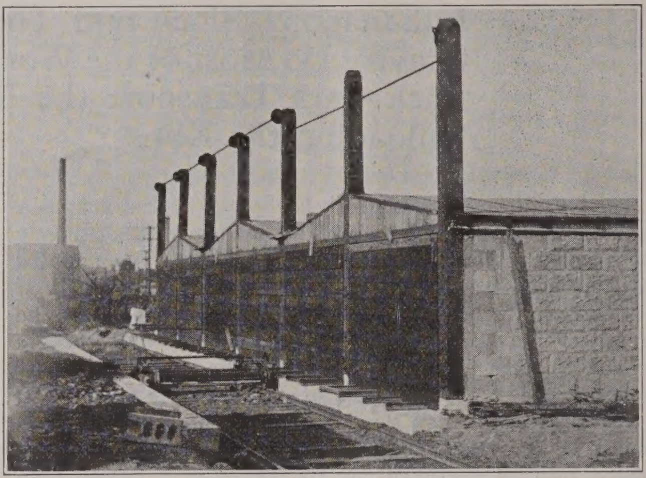
Track, set in the concrete floor, make it possible to run rack cars very close to each machine, in order that the off-bearers will not have to carry the newly-made block for more than a minimum distance. One or two steps are usually sufficient, and thus loading of the cars is effected with speed and but little labor.

As soon as each rack car has received a complete load of block it is pushed into a kiln, of which the plant has three, each with four tracks, and the curing is commenced. At the end of the curing chambers is a wide-gauge track, running at right angles to the movement of the product, on which is operated a very simple transfer car. This is run up to the end of the kiln track from which a carload of block is to be taken, the loaded car is run onto the transfer car, and the latter then takes it to the desired stock yard track. The rack car is then pushed onto the outer track and the block are transported to the point of storage.

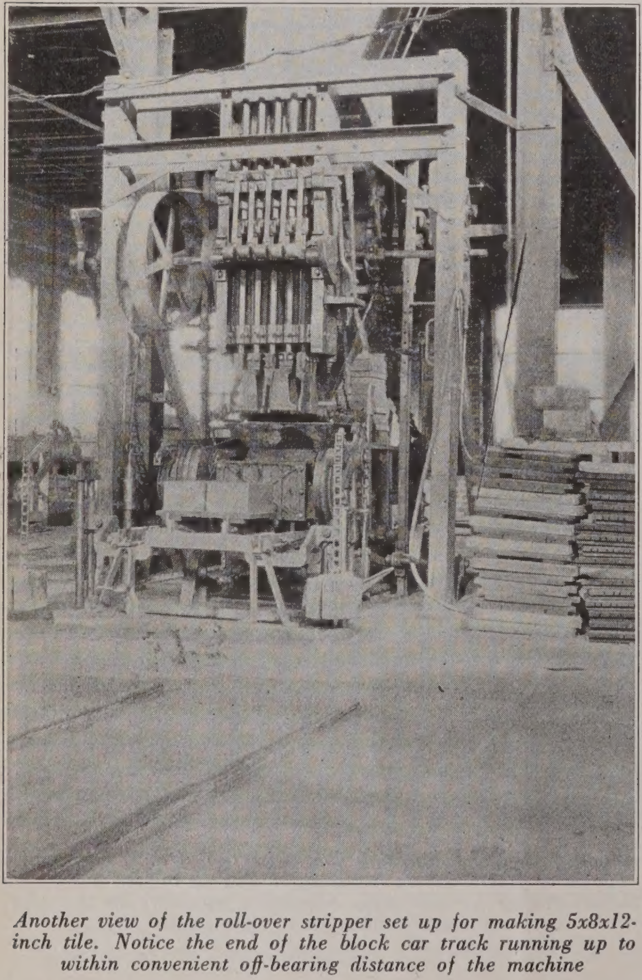
Other products of this interesting plant are sills, lintels, coping, caps, and garden furniture. The company advertises its products as being made scientifically. A sign on the gravel bin advertises the products to all passers-by.



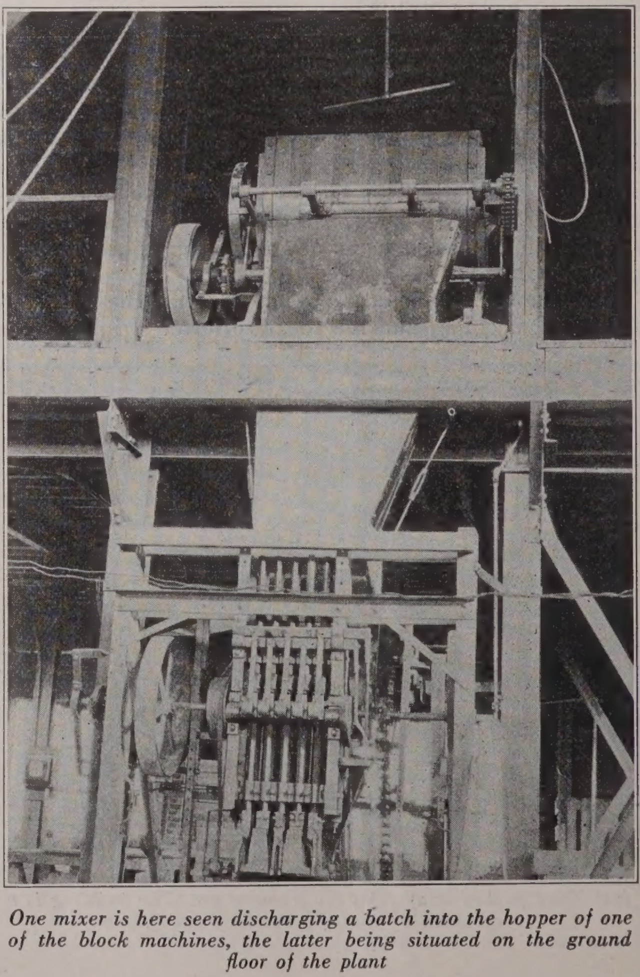
Here are the three block machines lined up on the main floor, with the roll-over stripper in the foreground, which is set up for the production of tile



This is the outer end of the kilns, with the transfer track and transfer car used to distribute the loaded block cars to any track in the yard



Another view of the roll-over stripper set up for making 5x8x12-inch tile. Notice the end of the block car track running up to within convenient off-bearing distance of the machine



One mixer is here seen discharging a batch into the hopper of one of the block machines, the latter being situated on the ground floor of the plant

EDITORIALS

An Earlier Check-up

Among the many valuable contributions to the practical technic of job control presented at the recent convention of the American Concrete Institute was the formula for forecasting the 28-day strength of concrete developed by W. A. Slater of the Bureau of Standards. Although somewhat overshadowed at the Convention by other and more familiar aspects of the job control problem, its importance should not be overlooked.

The development of the formula was a difficult and involved process, but the formula itself is a relatively simple one to use. Twenty-eight day strength (in pounds) equals the seven day strength *plus* thirty times the square root of the seven day strength. Granted the ability to extract the square root of the seven day strength, the rest of the problem is simple. And in this day of hand-books and slide rules, extracting the square root ought not prove any barrier to the rapid extension of the use of the formula.

The advantages of having such a formula available are obvious. By its use, much of a contractor's work may be planned and controlled as a result of seven day tests without the necessity of waiting the full twenty-eight adys. Check-up tests should of course be made at the end of the longer period, but the unusual accuracy of the formula makes it appear safe to proceed upon seven day data in many situations where twenty-eight day tests might of necessity be cautious, but the formula itself should become a familiar part of every contractor's equipment, for it is only by extensive tests in the field that the ultimate safety of the general application of the formula can be determined. And this fact, if once established, is going to mean a saving of many hundreds of thousands of dollars worth of time to the contractors of America.

A Double Opportunity

The Memorial Industry is beginning to feel the competition of concrete. The "Memorial Crafts News," a journal of the Memorial Craftsmen of American, editorially pleads for bigger and better policies and for outside capital and brains, that will be needed to rescue the industry from the "slough of financial despond." On another page of the same issue the editor speaks of plans under way to eliminate the "menace" of the concrete monument. He cites the fact that about 60 per cent of the monuments and stones now being installed in German cemeteries are made of concrete. In this country the monument industry is doing everything that it can to eliminate the new competitor.

Like lumber, the monument industry is running up against economic conditions that spell the end of the old order of things and of course is trying to resist the march of progress.

This published attitude only goes to prove the opportunity for products makers to give attention to the concrete memorial—whether it be mausoleum, monument, grave stone, or marker. It is just as permanent and strong as its predecessors. Its low cost opens up an immense market now unavailable to the high priced quarried stone. A lower priced product, just as satisfactory, will open the road to quantity production at a profit.

And the Memorial Craftsmen of America may well note that the concrete stone may be cast to approximate dimensions and then finished like natural stone by the craftsman, at but a fraction of the cost of granite. The concrete monument may easily be the savior of the monument craftsmen, even if not of the memorial industry.

Machines Are Not All

One difference between the concrete products manufacturer and the backyard producer is that the former operates a plant on a business basis, while the latter just makes block. Many a products manufacturer started as a backyard producer earning bare wages, but no matter how many machines he installed or men he employed he staid in the backyard class until he turned his plant into a factory. Although modern high-production machines can do a great deal, he soon finds that they are not paying their board until they are used in the way that the maker intended. Concrete units are a heavy material, and so are the materials that go into them. No plant, therefore, can pay its way until handling is minimized, until steps are saved, and until the work moves smoothly through the plant by the shortest possible route. Real planning, and not spontaneous growth, is necessary to make the plant equipment pay its way. Until the producer makes a real study of his conditions and arranges his work in order that he may obtain efficient operation, he is not to consider himself out of the backyard class. The other fellow, who does conduct his business along scientific lines, will have the edge on him, and salvation will lie only in the same direction.

Speeding Up with the World

The world speeds along. Men grow impatient with the things that erstwhile were thought to set the pace. All things must keep in step with progress or be discarded for those that can. Even portland cement, considered an excellent material of construction, is being criticised as being too slow for many builders. Chemists are sitting up of nights giving thought to improved methods that will create a portland cement that will be even more satisfactory. There is an increasing demand for higher and earlier strengths and for accurate means of predetermining the strength of concrete. There is a challenge here that must be answered with action. The world will not be content with makeshift methods and extemporized aids. There is a demand for still further improvement, and this improvement must, in part, take the form of higher and earlier strengths. Manipulation of present cements is of great aid, but when that manipulation presupposes, as it does, a greater care in the use of the material, then manipulation leaves much to be desired. Standard portland cement will some day be made so that it is not only more fool-proof, but so that it will reach mature strengths within but a fraction of today's time. Still closer cooperation between those who use cement and those who make it will hasten the solution of this problem.

Selling the Output

From Hand Machine Plant to Quantity Production, with 3000 Per Cent Increase of Output in Twenty-two Years —A Sound Merchandising Policy Did the Work

When a concern in twenty-two years of operating, increases the output of their plant 3000 per cent there must be real merit to the articles they are manufacturing as well as effective driving power in the selling organization. The Ideal Cement Stone Company of Omaha, Neb., has experienced this kind of success. In looking over their main plant and talking with A. V. Johnson, secretary and treasurer of the firm, the two basic points of successful concrete products manufacture stood plainly out at every turn. Namely, quality products at lowest possible cost and service in selling and installation. How this growing concrete block plant built its success is the purpose of this article and in no way would be complete without a brief history of its development.

Back in 1904, four masons, N. J. Peterson, his brother, Chas. Peterson, and two others who are no longer associated in the business started a block plant. The location was behind some sign boards on a vacant lot near the business section of the town. The first year just two men, N. J. Peterson as manager, superintended the plant where one hand machine turned out about 200 8x8x16-inch concrete blocks a day. One other man devoted his time to the mason work. The promoters were convinced that quality concrete units would gain in favor as a building unit. Naturally they were the first to realize the need of power tampers. One machine was soon installed as well as a concrete mixer and their output steadily increased. Soon all four men took an active part in the affairs of the company.

Overcoming Resistance

At this stage of development was encountered what then seemed an unsurmountable difficulty, but which soon proved a boon to their little industry. This was the opposition among bricklayers against their product. They were opposed to handling concrete masonry for two reasons. First, because of their weight concrete blocks are heavier to handle than brick; second, because of their size, they

The neat back yard of the south plant contains a small stock of units waiting delivery to the job. The plant appears in the background, where eight power machines try to keep up with the orders secured by the salesmen. Many carloads of units are shipped by rail to out-of-town dealers. Three cars were being loaded as this picture was taken

The front yard of the north plant, located on a paved street, has real advertising value. On the left is the garage, holding fifteen trucks, an
public attention—a r

lay up in the wall faster, cutting down the hours of labor on each job. Lastly might be added, brick has been on the market for centuries and any tradesman has a natural reaction to a new product from that in which he has been schooled. This opposition proved to be the best promotion that concrete building units could have ever received. It forced the manufacturer to sell his product laid into the wall.

The Ideal Cement Stone Company was one of the first to see this, and the careful and thorough workmanship they put into each contract job helped create favor with the building public. It is problematical whether concrete building units could have been introduced as quickly in any other way. In other localities concrete blocks have been brought into disrepute because of careless and poor masonry work. One manufacturer in the middle west will not sell his product, except to reliable masons. At the present time there are many competent bricklayers, masons and cement men who lay concrete units, therefore the company now devotes nearly all of its time to the manufacture and sale of its products and has practically discontinued its construction department.

Two Big Plants

Today the Ideal Cement Stone Company has two plants on trackage. One is in the north part of Omaha, at which plant their office and display room are located. Ten power machines turn out sand concrete and cinder concrete blocks. Here specials are also made such as copings, sills, lintels, trim, ornamental products, flower vases, boxes, bird baths, lawn seats, etc. A new department recently added manufactures roofing tile. The south plant operates eight power machines. Both plants are motor driven and equipped with 50 horsepower boilers, crane and clam shell for unloading. Hundreds of feet of pipe lead to bins where the concrete blocks are steam cured for 48 hours before being placed in the storage yards. The output of the two factories is about 6500 blocks 8x8x16 in. per day, in addition to the specials. Last year's total was 1,543,000 units manufactured. This year points to a big increase in both blocks and specials.

Marketing the Products

How do the salesmen work? Well! they are on the job to figure with any prospective builder or architect at the start. The uninformed are shown the display of products at the main office and are escorted to one of the innumerable masonry constructed homes in the city, to get first hand information on moisture, heat saving, fire safety, windproof, etc., that are troublesome to some. The factory maintains two full time salesmen with cars and their efforts are furthered by occasional help from the office force.

Several years ago a special effort was made to sell products into the territory outside of Omaha through the lumber and material dealers. This effort was made almost entirely through mail and the first year more than one hundred cars were sold. Each year since has shown a gain in this business. This enterprising company realized that quality products must come first and therefore have their products regularly tested by a local testing laboratory. Tests are frequently made on their aggregate so that a uniform product may be maintained.

It has taken a lot of hard work and close application to business to build up this industry. It may not be a large concern when compared with many other industries, nor has it amassed a great fortune. Its founders and promoters have had a lot of satisfaction in watching the business grow from almost nothing to an industry that employs over a hundred men. The growth has been a natural development and will no doubt continue.

Builders Attend Concrete School in New York

Builders and their key men went to school last month, in New York, and obtained a better idea of the cost-cutting qualities of better concrete. The school, held on April 7, 9, 14 and 15 at the Engineering Societies Building in that city, was devised to afford the experienced concretor an opportunity to learn of the newer developments in the field in the way of strength-control and in the predetermination of the strength of concrete. The course was designed to show the contractor and the engineer the most modern and effective ways to improve the quality and decrease the cost of concrete. The classes were carried on under the auspices of the Portland Cement Association, and under the immediate direction of B. H. Wait and J. W. Kelly, of that association. Similar courses are being offered to contractors and engineers in other parts of the country.

Normal business conditions will prevail in the Mid-West for the next three months. according to reports assembled by the Mid-West Shippers' Advisory Board, and announced during the past month.

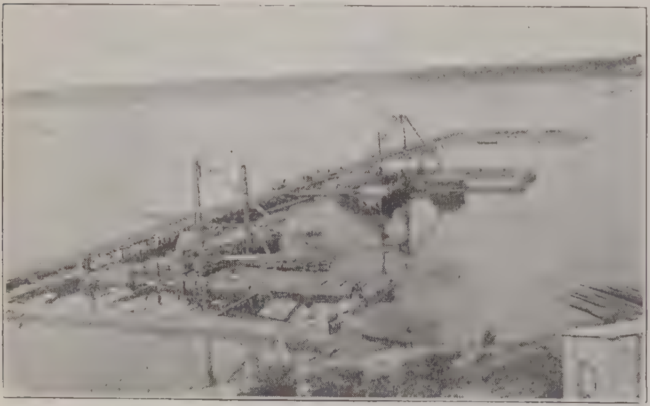
tar Brand Block are advertised on its front. To the right are the office, display rooms, plant, and storage yard, making a strong plea for lant well advertised

How They Concreted 19 Piers

A Floating Mixing Plant and Industrial Railway on Trestle Permitted the Mixing and Placing of Good Concrete in the First Piers for the New Montreal-South Shore Bridge, Now Being Constructed Over the St. Lawrence River—The Use of the Inundator Proved of Value

By P. L. PRATLEY, M. Eng., M. Inst. C.E., M.E.I.C.
Monsarrat & Pratley and J. B. Strauss, Engineers in Charge

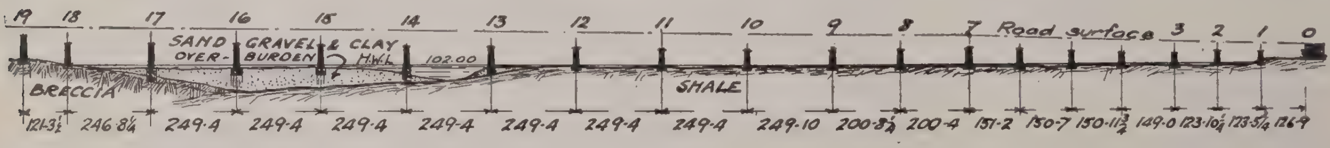
For fifty years or more, the project of a second bridge across the St. Lawrence, between Montreal and the South Shore, has been under consideration, and various proposals have from time to time been put forward, only to meet with financial difficulty or political opposition. The scheme finally materialized about a year and a half ago, when the Harbor Commissioners, under the presidency of by the Dominion Parliament, empowering them to finance, Dr. W. L. McDougald, succeeded in having a bill passed construct and operate a toll bridge under their own auspices. Engineers were appointed to design and supervise the work, Messrs. Monsarrat & Pratley, of Montreal, and J. B. Strauss, of Chicago, being engaged jointly. Plans were approved early in 1925, and the first contract was let in May for the substructure work on the south side, construction beginning in June.



Here are the cribs for Piers 17, 16, and 15, with the railway that brought in the concrete

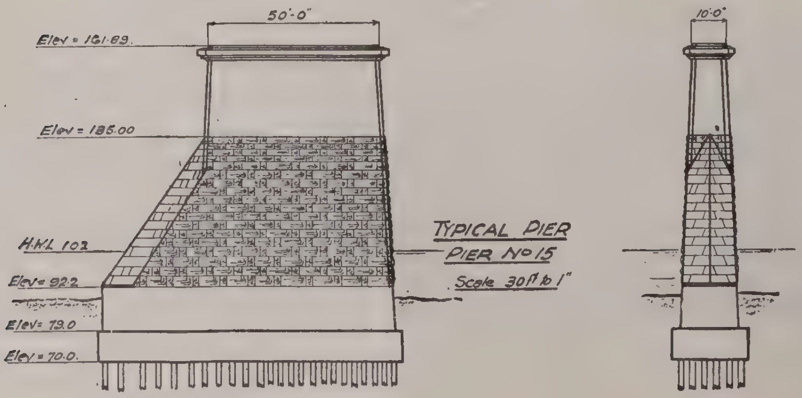
The site chosen is that known as the Delorimier Avenue location, opposite the north end of St. Helen's Island; and the bridge center line is taken across the ship channel by the shortest span to the Island, and thence eastward to the south shore. The Island thus divides the bridge into two sections,—the first, or easterly half consisting of twenty deck truss spans, varying in length from 122 to 245 feet, with a total length of about 3800 ft. The western section joining St. Helen's Island to the city of Montreal is about 2700 ft. in length, and its main feature is a cantilever span across the deep water channel, with a clear waterway for shipping of 1000 ft., and a vertical headroom of 163 ft. clear above high water. The city streets are then reached by a viaduct about 2300 ft. long, composed of deck truss spans, supported on steel trestle towers, 3 concrete arches and a short retained fill.

The first contract was placed with Messrs. Quinlan, Robertson & Janin, and included the construction of the south shore abutment and 19 piers, of which the majority were within the area of the river bed. Toward the end of November the river commences to freeze up, and until April the ice conditions render work in the river im-



GENERAL VIEW – SOUTH SIDE PIERS.

Scale 300 ft to 1"



General view of the south side piers, showing their location and the topography of the site. Below—A typical pier, illustrated by Pier No. 15 practicable, both because of the difficulties of access and of transport, and the disturbing or destructive effect of the moving ice.

Concrete—With Stone Facing

The piers liable to be exposed to the ice are provided with adequate cutwaters of dressed limestone and are faced all around between the elevation of one foot below low water and the highest known ice with rock-faced ashlar, the height of this stone work being 42 ft. 10 in. for all piers in the water. The remaining portions of the piers are constructed of concrete of different values, with foundations carried to rock in all cases but two, where the depth of over-burden was prohibitive and where timber piles were driven to refusal in the hard packed gravel.

The first year's program for the eastern section included the building of the south shore abutment, known as Pier No. 0 and the footing of Pier No. 1 on the south shore; the completion of two piers, 18 and 19, on St. Helen's Island, which were carried out entirely on dry land, and the construction of the footings of three of the principal piers in the river to the east of the Island. These latter shafts were brought up to such an elevation above low water as would enable work to be continued in the following spring, without undue delay and without having to re-construct the cofferdams. These operations were brought to a successful conclusion by the end of the working season, and the contractor's plant removed in time to avoid the freeze-up.

The south shore abutment and the footing of Pier No. 1 were first undertaken and presented no unusual features. A ½ cu. yd. mixer was used, the concrete being hoisted by the usual type of elevator, and distributed by buggies, this being found more convenient than chuting. For the rest of the work, it was decided to install a sand inundator, in order to obtain more efficient control of the water content.

Inundator Found Necessary

It has been long recognized by engineers that, within the limits of workability, the less mixing water is employed in concrete of a given mix, the stronger the resulting material will be. To obtain uniform concrete, therefore, it is necessary that the water-cement ratio should be constant as well as the ratio of cement to aggregate. In practice, one of the commonest causes of lack of uniformity in this respect is the varying moisture content of the sand. If dry sand becomes wet from any cause, two new factors are at once introduced. The sand bulks in handling to an extent that can only be ascertained by careful test, and it has acquired a water content which will upset the proportion of mixing water intended in the concrete at the time. It may be that sand has been obtained by dredging from river bottom and was originally saturated, but that the heap on the work has irregularly dried out; or, the sand may originally have been practically dry and may have become partly wet from rain or other cause. In either case, a constantly varying element is introduced, both in the volume of sand and in its water content. This state of affairs renders it almost impossible to control the proportions in the mix accurately by means of the measuring devices ordinarily adopted.

A closeup of the same installation, showing the inundator just emptied and ready to return to loading position, as shown in the other view

The inundator and batcher as installed on the work, getting ready for another batch

If, however, the sand can be inundated, or flooded, in a water-tight measuring container, both the sand and the water used to inundate it, have constant volumes for a given grade of sand, irrespective of the amount of moisture which the sand previously contained. Appliances for inundating the sand in this way have recently been introduced and have been used on several important works in the United States, but it is believed that the plan installed in this work was the first of its type in Canada.

The Inundator Explained

The inundator consists of a vertical, cylindrical steel receptacle, with a sliding adjustable bottom and suspended on trunnions, so that it can be easily dumped into the mixer hopper. When the bottom has been adjusted to give the required volume of sand for the batch, water is run in through a three-inch pipe until the inundator is

The floating mixer plant that delivered concrete to a narrow gage railway, on which the batches were delivered to the forms. One barge held the crane, batcher plant, mixer, and hoist, while another held the cement shack, and two others brought in the aggregates

This view shows Pier 18 under construction, with Pier 19 in the background. Simple and effective formwork facilitated speed in construction

about one-third full. Any excess water runs off through an overflow as the sand is run in from above to fill the vessel. If insufficient water has been charged, more can be added by the operator as the sand flows in, but after a few batches he is able to gauge the amount fairly accurately, so that there will be enough to flood the sand without losing an excessive quantity via the overflow. Control of the flow of sand is effected by a shaker gate composed of five vanes of the butterfly type, which gives easy regulation, and at the same time distributes the sand evenly through the water. When the receptacle is full of sand, the bin is closed by a strike-off gate on roller bearings operated by a rack and pinion. A small quantity of sand between the overflow and the strikeoff gate remains unflooded, but this is insufficient to have any appreciable effect on the mix.

The inundator is dumped by releasing a catch when sand and water are discharged together into the hopper. Whatever additional water is required is discharged at the same time through a 3-in. pipe from an adjustable auxiliary measuring tank. The trunnions supporting the inundator are so placed that, when full, the latter tends to overturn of its own accord when released. A counterweight attached to the bottom by a cable assists in starting it past the dead-point. It is held automatically in the dumping position by another catch, and when this is released the inundator returns by gravity to the vertical position.

The amount of auxiliary water required varies with the grading of the sand used, and the desired wetness of the mix. In one or two cases, it was found that even without any excess water the mix proved to be rather wetter than desired. This was due to too great a uniformity in the size of the sand grains, and the only remedy in such cases would appear to be the employment of a better graded sand, that is, a sand with more variety in the size of its particles. An advantage obtained from the use of the inundating method, which perhaps the makers of the machine did not foresee, was discovered during the progress of the work. In certain sands taken from river beds where logging operations have been carried out, fragments of bark or wood-chips are liable to be found. These, while not appearing to have much effect on the strength of the concrete, do cause the sand to show a high humus content in the caustic soda test. It has been found in practice that most of these impurities are washed out of the sand in the inundator and are carried away with the overflow.

It must not be assumed that by sand inundation all troubles due to the varying consistency of the concrete can be avoided. Any marked change in the grading of the aggregates, either sand or stone, requires a correction in the amount of excess water provided. The moisture content of the stone may also vary, but this is usually unimportant compared to the possible variation in the moisture of the sand, and it must be admitted that by inundating the sand, this very fertile source of irregularity is removed. A similar installation is already provided on the north section of the bridge by the Dufresne Construction Company, the contractors for this second portion.

For measuring the stone, a square steel batcher is used, telescopic in design, in order to regulate the volume, and adjustable by means of threaded bolts at the corners. This is situated alongside the sand container and is also fed from an overhead bin and discharged into the mixer hopper below. A strike-off gate on roller bearings again closes the intake and a swinging door below is opened by releasing a catch to discharge the contents, closing again automatically by means of a counterweight. One man was used to operate each of these batchers. The mixer hopper was of one cu. yd. capacity and the batch was elevated and discharged by chute into bottom dumping buckets, also of 1 cu. yd. capacity. These were hauled by gasoline locomotive to the various piers and there handled by stiff-leg derricks.

Floating equipment was used throughout the work. The mixing outfit was erected on a scow, together with the derrick which operated the clam-shell grab for keeping stone and sand bins replenished, and the hoist for elevating the batch of concrete. Scows containing stone and sand were towed to the site and anchored alongside on either flank of the mixer scow. Another scow housed the cement shed, from which the cement in sacks was carried and fed to the mixer by hand. A service trestle carrying a narrow gauge railway was constructed on the river bottom to serve all the piers being handled by this mixing plant. The time required for mixing, which was one and a quarter minutes per batch, appeared to be ample for all the operations of charging and dumping the inundator, so that no time was lost after the men became accustomed to the installation.

The three river piers, Nos. 15, 16 and 17, were carried out in open cribs. Timber cofferdams were first constructed on the shore of the island, floated out to their respective sites and sunk by stone. Steel sheet piling was driven inside the crib and the excavation undertaken by hand loading on to skips. The piers were successively unwatered by pumping, and all foundation concrete was placed in the dry, with the exception of a small portion which filled in a sump where the buckets were lowered to the bottom and the dump doors tripped open. Two of the piers are partly supported on timber piles driven into the hard-packed gravel, while the other (Pier No. 17) is concreted to rock.

March Construction Totals a Half Billion Dollars

The F. W. Dodge Corporation has announced that last March broke all records for contracts awarded, and the volume was exceeded only by the awards of last August. Contracts totaling $597,879,300 were awarded to builders in the 37 states east of the Rockies, according to the reports, making a 53 per cent increase over February and an increase of 22 per cent over March of last year. Residential buildings accounted for 44 per cent of the total, 18 per cent was spent on commercial buildings, 17 per cent for public works, 8 per cent for industrial buildings, and 5 per cent for educational buildings. Total committments for the first quarter amount to $1,444,937,700, which is a 30 per cent increase over the first quarter of last year.

Paving a Railroad With Concrete

A Section of Reinforced Concrete Roadbed Slab to Be Tried by Pere Marquette Railway

By FRANK H. ALFRED
President and General Manager, Pere Marquette Railway Co.

In favor of concrete roadbed for railroad tracks it is pointed out by the author that many roads have adopted a permanent track in tunnels, at passenger terminals and in some cases at outlying points, and the results of such construction are a success. Street railways have been using concrete track support in the paved streets of cities successfully, eliminating almost all track maintenance.

By permanent track is meant a track structure in which wear and deterioration are confined as far as possible to the rail. Such a structure must be wide enough and strong enough to distribute the load over such an area that the bearing power of the sub-grade will not be exceeded. Allowance must be made for impact, for lack of uniformity in the support given by the sub-grade and for the present tendency toward heavier loading. Temperature stresses must be taken into consideration, and protection of the concrete under the rail from disintegration due to repeated shock from passing loads seems desirable.

The method of attaching the rail should permit of its easy placing and removal. Methods and type of construction must be such that the rail, when laid on its prepared place, will have perfect surface and alignment. Minor adjustment of elevation by shimming should be permitted by the design and ease of insulation should not be overlooked.

The foregoing features have all been considered in the proposed design described as follows: The supporting slab of concrete is 10 ft. wide and 18 in. thick. Assuming the use of 30-ft. rails, the concrete would be cast in sections of that length. The rail rests on the edges of two plates which are embedded in the concrete, and are perforated in order to provide better bond and more bearing on the concrete. These serve a fourfold purpose: (1) To distribute the load and impact over a greater area of concrete; (2) to protect the concrete from shock and possible disintegration due to direct contact with the rail, and (3) to insure a setting for the rail which is absolutely true as to line and surface. (4) In addition, they form a guide for striking off the concrete surface in finishing.

Truss Reinforcement Employed

The plates which form the rail seat also form the upper chord of a light truss, the lower chord of which serves as a part of the longitudinal reinforcement. The vertical members of this truss serve to anchor the rail seat to the concrete and are extended below the lower chord, so that they may rest upon stakes driven accurately to the elevation of the sub-grade. This truss would be shop-made, and the bracing and riveting need only be of sufficient strength to prevent distortion while handling. When set in place these trusses are connected by adjustable tie rods spaced 6 ft. apart, and also by the brace frames shown on the drawing. Four of these brace frames are used for each 39 ft. section. One of the tie rods forms the upper member of the brace frame. This arrangement gives a rigid framework which can be set accurately in place and will remain undisturbed while the concrete is being placed. It will also serve to transmit the loads into the mass of concrete.

Longitudinal reinforcement consists of four ¾-in. bars and four ½-in. bars in addition to the two 1½x1½x¼-in. angles which constitute the lower members of the trusses. The ratio of longitudinal reinforcing metal is about 0.37%. Assuming a Cooper E-70 loading concentrated under the axle, with 50% allowance for impact and uniform bearing on the sub-grade, the tensile stress in the steel would be about 9,000 lbs. per square inch and the compressive stress in concrete would be about 200 lbs. per square inch.

Transverse reinforcement consists of ¾-in. square bars spaced 18 in. center to center near the base of the slab and ½-in. square bars spaced 18 in. center to center near the top of the slab. Where brace frames and tie rods occur, other transverse reinforcement is omitted. Assuming the 70,000 lbs. on a pair of drivers to be uniformly distributed over a longitudinal distance of 5 ft. and again assuming an impact allowance of 50% and that the upward pressure of the sub-grade is uniformly distributed, we obtain a unit tensile stress of 14,000 lbs. for the steel and a unit compressive stress of about 300 lbs. for the concrete.

Economy From Design

These unit stresses are ample to take care of any increase in future loads, impact and unequal sub-grade conditions. On account of the greater length of the section as compared with its width and the consequent opportunity for more variability in the condition of the sub-grade it is thought desirable to use a much lower unit stress for the longitudinal reinforcement than for the transverse. With modern methods of proportioning and making concrete, the maximum of economy may be obtained through designing the concrete to meet the actual condition of stresses disclosed through experience in the use of this type of roadbed. It might seem that some economy in design could be attained by not using so thick a slab and using a higher percentage of reinforcement. On account of the impact, however, it is believed that the additional mass obtained by using a greater thickness is well worth its additional cost.

Method of Construction

In order to facilitate construction, the concrete slab should be poured continuously, and not in alternate sections. A metal separator would be placed at the end of the section being poured. After the adjoining section had also been poured, this separator would be removed. It is not planned to leave any well-defined joints between the sections, on the assumption that compression due to high temperature would easily be taken care of by the concrete, the thickness of which would prevent any tendency to buckle; and that tensile stresses would cause a cleavage at the end of each section, inasmuch as none of

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From a paper read before the 22nd Annual Convention of the American Concrete Institute. Abstracted by permission.

the longitudinal metal is continuous. When these joints develop they should be filled with tar, as is now done with concrete highways. In construction the removal of the separator would be delayed until at least a portion of the block ahead of it was poured, thus giving the block behind it a start toward setting and insuring a cleavage practically along the plane of the separator.

The rail is held by rail-clips, which are attached by bolts to stirrups bolted to the perforated plates and embedded in the concrete. The bolt is placed with the head up and screwed into a nut which is inserted beneath the stirrup through a recess provided for that purpose. This recess is only slightly wider than the nut, thus preventing it from turning. This arrangement tends to lessen the danger of injury to the bolts in case of derailment, and permits their replacement if injury should occur, or the substitution of a longer bolt in case slight shimming is desirable. No angle bars or fish plates are necessary, as the rail seat and rail attachments serve their purpose.

With such a design, the rail no longer functions as a beam. A wearing surface and a base for bearing and attachment are all that need be provided, so that a much lighter rail may be used than at present.

Rail anchors are not needed. If it should prove desirable to give a slight cushioning effect and lessen the impact on the concrete, it is believed that a thin layer of oiled felt beneath the rail would be effective.

Thorough drainage is essential. On fills other than sand, drainage should be taken care of by tile drains just beyond the edges of the slab. Conduits for carrying all wiring, such as telegraph, telephone, block signals and train control can be placed in the center of the slab.

The estimated cost per mile for material, including rail and fastenings and concrete base, is $34,103. Labor, engineering and diverting traffic are estimated at $14,658 per mile, making the total estimated cost per mile $48,761. The estimated cost per mile of rail and accessories in the present track that would be retired is $10,791, making the net cost per mile of the permanent construction $37,970.

It is the intention of the Pere Marquette Railway Co. to install a short section of this track during the present season and to determine the necessity, if any, for placing a resilient substance between the rail and the concrete.

Three Unusual German Structures of Concrete

By E. LEE HEIDENREICH

Beton U. Eisen, Heft 20, 1925, gives a fascinating historical review of the advance of reinforcing concrete from the inventive genius of Joseph Monier, through the constructive hands of Dr. Freytag, the mathematical application, of Mr. Wayss, Dr. Matheas Koenen, Prof. Dr. Eng., E. Moersch, and other great German and Austrian engineers, all working parallel with the splendid French engineers, not however, mentioned in the article.

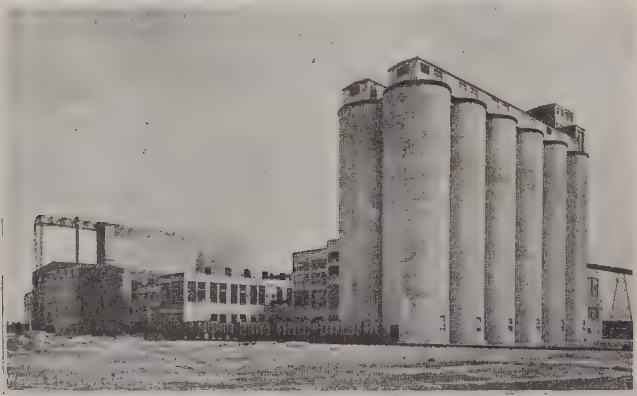


Fig. 1. A Heidenreich cluster grain tank structure, of reinforced concrete, built recently in Europe.

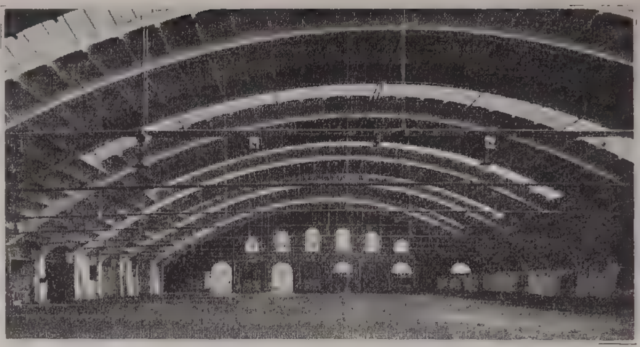


Fig. 2. A 150 ft. span arched beam roof, reinforced concrete, in Vienna.

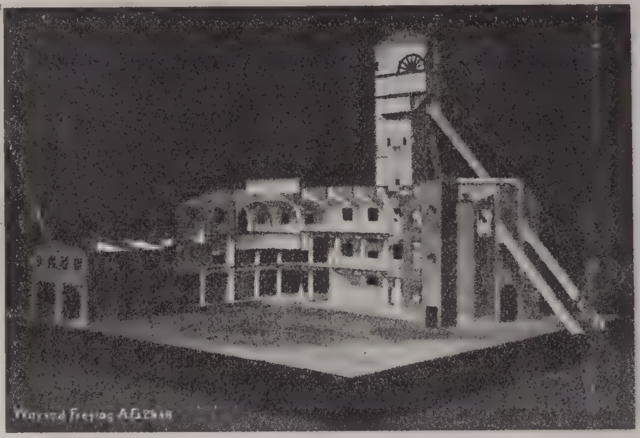


Fig. 3. Model of mine shaft hoist and tipple, showing unusual design.

That the Wayss & Freytag Company were willing to adapt foreign engineering and construction improvements in reinforcing concrete applications, is shown in (Fig. 1) which illustrates a Heidenreich fireproof cluster tank construction as patented in the United States in the year of 1901, utilized by Wayss & Freytag Company in 1922, as corn storage.

(Fig. 2) further shows a 150-foot span arched beam construction, built in Vienna, the like of which has not been seen in the United States to date. Finally (Fig. 3) shows an application of reinforced concrete construction in the support for a shaft, hoist and tipple, which certainly also will be considered a novelty in the United States, built as it is without connection to the inclosing structure.

It is interesting to note that all the great pioneers in engineering construction in Europe, not only are recognized by frequent encouraging and appreciative mention in magazines during their lifetime, but at the end of their useful and creative manifestations of genius and enterprises, the entire European magazine world joins in patriotically extolling their engineering virtues.

A new chemical compound that waterproofs concrete foundations, stucco, and other concrete work, and that is said to make concrete proof against alkaline waters, has recently been patented by B. F. Erdahl, chief chemist of the Duluth plant of the Universal Portland Cement Co. This material is now reported to be manufactured and marketed by the American Algin Products Company of Duluth.

Road Bureau Studying Means of Cutting Paving Costs

The building of a national highway transportation system is considered as a trust by the Bureau of Public Roads and the bureau feels that this trust can not be faithfully administered without constant effort to broaden the field of scientific knowledge of the materials and processes employed in the construction. The highway researches of a physical and an economic character in which the bureau has been engaged for a number of years are regarded as a highly important department of its work.

In a report of the Bureau of Public Roads of the United States Department of Agriculture, it is pointed out that the most significant results have been obtained in the following three branches of this work: The development of the managerial methods, the application of which in test projects has cut the costs of construction of concrete paving virtually in half; the second development is of methods of analyzing the flow of traffic over a highway system and the application of the results of such analyses to the economic improvement of the system; and the third, the outstanding advance which has rewarded the prolonged study of highway subgrades.

A field study and careful analysis of the elements affecting the cost of grading and concrete paving which have led to the development resulting in the cutting of costs are considered as the most practical and immediately beneficial study ever made by the bureau. The methods of analyzing the flow of traffic over a highway system have been applied in California, Maine, Connecticut, Pennsylvania, Ohio and Cook County, Ill., and have been instantly recognized by the State and local officials as a most valuable aid to administration. Practical methods have been devised for the identification for suitable soils and there is reasonable ground, the bureau believes, for hope that corrective treatments will soon be developed that will make it possible to overcome the handicap of unsuitable soils.

In the analysis of construction costs the first work was a study of the operation of earth moving equipment. Beginning with the lighter equipment such as slip scraper, wheelers and fresnoes, the investigations were later extended to include the operation of elevating graders, steamshovels, drag lines and dredges. Each type of equipment has been studied in operation with the object of determining the extent of the preventable time losses. Such losses have been detected even on well managed projects, their presence wholly unsuspected by the contractor because of the lack of a detailed study of the operations involved in the work. Once detected it is a comparatively simple matter to eliminate them by careful management; and the tests made indicate that savings of from 25% to 35% of the earth moving cost may be made on average projects.

Concrete Paving Studies

The concrete paving studies have had a similar purpose, i. e., to develop precisely the reasons why production so commonly fails to reach rates theoretically attainable. The observations made have clearly established these reasons, and the bureau has induced a number of contractors to make the changes in operating methods shown to be necessary with the most striking results.

In one case production under the contractor's management had averaged 36 lineal feet of pavement an hour and about 180 feet a day. As a result of suggestions made by the bureau's engineers production rose steadily during the test period of about a month to an average of 62.5 feet an hour attained during the last nine days and the daily production increased even more sharply as a result of elimination of heavy time losses which had the effect of increasing the length of the working day. The effect of this improvement was to reduce the labor cost from $0.457 per square yard, which had been the average cost to the contractor, to $0.203 per square yard.

On another project the contractor's production had averaged 64 feet an hour and 486 feet a day. The suggestion made by the bureau's representative raised the output to a seven day average of 97 feet an hour and a maximum of 101 feet for 12½ hours, a day's run of 1,260 feet. In this case labor had cost the contractor $0.207 per square yard of pavement laid as against a cost of $0.128 per square yard for the last week of the test period. Under the contractor's management 35,743 sq. yards were laid in slightly over two months, while during the last week of the test period 10,096 sq. yards were laid, and this in spite of the fact that of the six working days one-half day was lost on account of rain and another half day at the end of the period by the completion of the pavement to be laid at noon of the last day.

These investigations in general cover researches the aim of which is to establish facts which will lead to durable and economical pavement design, more economical use of road materials and better combinations more suitable for present day motor truck traffic, and finally, to obtain data which will serve as the basis for legislation pertaining to motor vehicles in their relation to the highways.

Subgrade Materials

The work on subgrade materials is one of the major research projects. This work is subdivided under several headings which include bearing value, determination of physical characteristics of subgrade materials, the effect of moisture and the effect of alternate freezing and thawing; also field investigations to determine what method of treatment is necessary to properly prepare and improve a subgrade preparatory to building the road surface. A tentative classification of subgrade material has resulted which aids in interpreting and predicting subgrade conditions. This classification requires the determination of several physical characteristics, the tests necessary for which have been further revised and developed. The methods of examination, testing and treatment of subgrade materials and subgrades while very greatly advanced, are not fully satisfactory in their practical application, and the main effort during the past year, which effort is to be extended has been to develop simple and practical methods.

Measurements of Stresses in Concrete Roads Under Actual Road Conditions

This subject includes the determination of actual stresses and deflections of concrete roads of different designs of specially constructed roads under influence of actual traffic. As a result of the investigation the distribution of stresses in road slabs under heavy traffic have been discovered and this investigation in connection with others already conducted has resulted in a more rational method for the design of concrete road surfaces. These researches on road design have undoubtedly had very great influence in producing much more durable and economical pavements throughout the country than have been built in the past, and millions of dollars were saved in the past year alone through the use of designs thus established. Thirty-three of the states have now adopted the design which these investigations and others have brought about.

Bridge Design

A series of tests to determine the action and strength of skew arches has just been finished. These studies have been conducted over a period of two years. Some very definite and positive results have been obtained showing the load reactions and thrust on skew arches, which are of vital interest to engineers engaged in bridge design.

This project has been conducted in cooperation with the Rubber Association of America and the Society of Automotive Engineers over a period of about two years. Its purpose is to determine the destructive effects of motor trucks on road surfaces. The impact of motor trucks has been determined under a variety of conditions of load, speed, type of truck, tire equipment, and character of road surface, and the results of the tests have made it possible to predict the relative effect of motor trucks on roads under several conditions.

Non-Bituminous Road Materials

Miscellaneous small tests have been conducted to establish particular facts in connection with the use of materials from certain sources of supply. As the result of these special tests, materials have been made available for use which previously had been thought to be unsuitable. Additional work has been done during the past year in devising an abrasion test for concrete sands which will indicate the quality of the grains. A number of samples of sand have been subjected to a special abrasion test using the Deval abrasion cylinder, and preliminary conclusions indicate that the test gives in general, a good idea of the durability of the grains.

A considerable amount of work has been done on the question of size and shape of screen openings for sieving. This is a matter which is involved in specifications for materials and which has caused considerable trouble in the past.

Measuring Consistency of Materials

A new device has been constructed, after investigation, which satisfactorily measures the consistency of concrete in the field as well as in the laboratory. In view of the established fact that the proper consistency is the chief factor in controlling the strength of concrete, the importance of this development can not be overemphasized. Its use should make possible the construction of concrete structures of considerably higher strength and greater durability than those built in the past.

Apparatus has also been devised for measuring the pressure in moulding cement briquettes, which will make for greater uniformity in testing and correspondingly less contention in regard to the acceptance of cement based on tests. Tests have also been conducted looking toward the determination of the effect of quality of cement on the compressive strength of portland cement concrete. An extensive series of tests has been run on high-alumina cement, which has recently been used extensively for special work in connection with highways and bridges. These tests aid in establishing the limitations of the cement, the conditions under which it should be used, and the way it should be handled.

A series of investigations to determine the cause of scaling of concrete roads has also been finished. Five hundred and twenty-six specimens of concrete were subjected to freezing and thawing, and various factors thought to be productive of scaling were investigated. Many of the specimens scaled or completely disintegrated in from 40 to 140 alterations of freezing and thawing.

Minnesota Products Group Now Very Active

The Concrete Block Manufacturers Association, with offices at 308 National Building, Minneapolis, is showing many signs of activity. According to W. W. Gibson, executive manager, the organization is functioning nearly 100 per cent, and is embarking upon a program that fits in well with the present program of the national association. A concerted drive is being made to obtain certificates of quality for as many members as possible, new Estimate Books are soon to be distributed, a credit system and cash list will soon be ready for the convenience of all member plants, and other interesting things are being accomplished. A dinner held at the West Hotel, on April 15, afforded the members a good opportunity to get together and discuss their mutual problems, and was well attended.

The program for this year, besides obtaining a greater number of Certificates of Quality for the membership, includes the institution of scientific methods of control in more plants, the application of modern merchandising and advertising methods to broadening the local markets for concrete products, agitation for the passage of and enforcement of laws that will require a better quality of product, education of the industry and the public on the making of and the use of good products, a vigorous campaign for equitable insurance rates on concrete masonry construction, obtaining more favorable freight rates on concrete units, promoting more "above the grade" concrete masonry construction, securing the use of concrete masonry on the larger buildings and a campaign to increase the membership of the local, state and national organizations.

Better Homes Week in Minneapolis, ending May 1, resulted in some good publicity for concrete masonry construction.

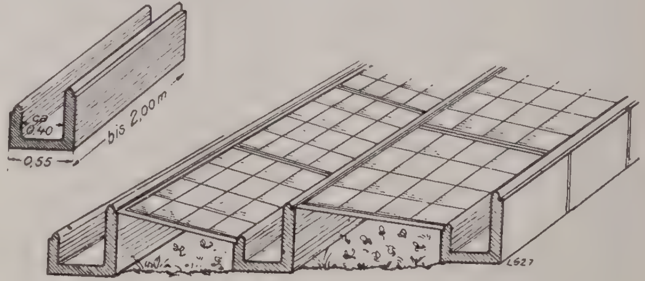
Reinforced Concrete Hotbeds

(Tonindustrie-Zeitung)—E. Lee Heidenreich

One of the best paying concrete products in Germany and France today is garden furnishings, such as pots, basins, benches, fences, ornaments—and hotbeds.

Our illustration of a hotbed from a cut in Tonindustrie-Zeitung really explains itself. The troughs are made in any length up to 6 ft. 6 in. and reinforced with wire fabric.

The cost is far below the old wood construction and the maintenance practically nil.



The University of Nebraska is conducting a series of compression tests on reinforced concrete culvert pipe of the types now being used in Nebraska highways. The tests to date have proven that pipe larger than 18 inches in diameter require more than a single line of reinforcing, and the state specifications are now being revised, and a new series of pipe, with more reinforcing and different shell thicknesses, will be tested.

The Minnesota Highway Department is reported to be studying the effect of calcium chloride on concrete when used as an admixture and as used for surface curing. The same organization is studying the effects of freezing concrete at various ages. Both investigations will have a bearing on future changes in state specifications and methods.

No Need to Wait the 28 Days

The Strength of Concrete at an Age of 28 Days May Now Be Estimated with Fair Accuracy When the 7-Day Strengths Are Known—The Formula to Use—A Necessary Guide on the Work

To strip the forms or leave them up—that is the question perplexing the contractor on every job. So many things can go wrong, it seems, that the contractor breathes a sight of relief when the forms do come down and the job is still there—standing as solidly as the everlasting hills. No matter how carefully every detail of the work is watched, no matter how thoroughly science stood on guard at the mixer, the contractor will always experience that anxiety—especially in the spring or fall when the weather steps in to play pranks with the concrete, or when the material man appears to have changed to aggregates from a source that may be untried, or to a cement that is not the same brand as the contractor is ordinarily in the habit of using.

Job schedules have a foundation based upon the specifications, and these almost always base their provisions on the strength of the concrete at the age of 28 days. On many a job, however, things cannot be held up while waiting for the official tests, and the work has progressed so far that it would be rather expensive for the contractor to retrace his steps, and replace defective work that was done a month before.

It is therefore very important to the contractor that he have some reliable method of determining the probable 28-day strength of concrete before it is more than a week old.

Engineers have long appreciated the situation and the feeling of the contractor on this point, and they have for some time been trying to work out some scheme by which this long waiting could be reduced to a more reasonable and practicable period. If they could prove a definite relationship between the strength of concrete at 7 days and the strength of the same concrete at 28 days, then the problem would be solved. So they made many tests in the laboratory, trying all conceivable mixes, aggregates, consistencies, curing conditions, and admixtures. Several investigators in as many laboratories, all working independently, made observations that have at last come to the point, it is thought, of practical application. Several formulas were proposed, but the one that appears to give the most gratifying results states that the strength at 28 days equals the strength at 7 days, plus 30 times the square root of the strength at 7 days. The mathematicians express it this way:

$$S_{28} = S_7 + 30\sqrt{S_7}\ .$$

or, more correctly, they write it as follows:

$$f'_c = f + 30\sqrt{f}$$

The former is probably easier to remember, since the letter "S" is an abbreviation of "strength" and the sub-figures distinguish clearly between the 28-day and the 7-day strengths. The latter version is the one used by the research engineers, but uses a more arbitrary system of symbols for the strengths at the two ages.

With this formula, the contractor can get his cylinders tested at the end of seven days, compute the probable 28-day strengths, and with that information proceed to take whatever precautions that may be found necessary to insure the success of the work. The lag of 28 days between trial and correction has proven embarrassing to many a builder, but now that the lag has been reduced to 7 days the work should proceed with greater certainty.

It is unnecessary, here, to go into a discussion of the mathematical significance of the proposed formula, or of the several straight line formulas that were suggested by the several investigators. It is enough to state that the formula given here was found to more nearly apply to the complete range of mixes, with and without the use of various proportions of the several commonly used admixtures. The straight line formulas, on the other hand, coincided with the test data on but a small range of mixes, and could not be relied upon for really acceptable results. The suggested formula appears to give results that are within the range of error found under job conditions or even in the laboratory.

With this formula, which is easy to use by any man who is able to do simple arithmetic or use the slide rule, the contractor can compute the probable 28 day strengths of his concrete on the basis of 7 day compressive strength tests on samples from his mixer. It is a simple matter to take an occasional bucket full of concrete from the chutes or buggies and cast ten cylinders to send to the laboratory. These cylinders are allowed to cure under job conditions, or in wet sand, for the required seven days, and then sent to be tested. Upon receipt of the laboratory report on the cylinder, which will give the compressive strength of the specimen in terms of pounds per square inch, the contractor may then substitute the value given for the S_7 value in the equation, and quickly calculate the strength that the same concrete should reach at the end of 28 days.

Here is how the problem works out. Let us assume that the laboratory reports the seven day strength as 1750 pounds per square inch.

Since the formula says that the strength at twenty-eight days will equal the strength at seven days, plus thirty times the square root of the strength at seven days, it is

TABLE OF 7 AND 28-DAY STRENGTHS

7-Day Strength	28-Day Strength
250	620
500	1170
750	1570
1000	1950
1250	2300
1500	2660
1750	3000
2000	3340
2250	3670
2500	4000
2750	4300
3000	4640

This table, computed from the standard formula, gives comparative 7 and 28-day strengths for concrete ranging from 620 to 4640 pounds. The use of this tabulation will save computation. Simply use the 7-day strength nearest the one reported from the laboratory, and read the 28-day strength of the same concrete shown in the second column only necessary to find the square root of 1750 (getting it from your handbook or on the slide rule), which equals 41.83, multiply this by 30, which equals 1254.90, and add to this amount the strength at 7 days, or 1750, which then gives the amount of 3000 and a fraction pounds. This amount is the predicted strength at 28 days, and will be found to coincide closely with the strengths actually obtained at that age.

This method of arriving at the strength of the concrete by means of early tests should prove useful to the contractor. It will serve as a guide on his selection of aggregates, on his proportioning methods, upon weather conditions and their effect upon curing, and in certain other matters as well. With this knowledge at his disposal he will be better able to tell when it will be safe to strip the forms and to remove the shores. He will be able to check up on changes in the supply of aggregates that may dictate a change in proportions. And it will, without troubling him, afford information that will be of service to him when it is not yet too late for it to be translated into action.

Concrete Boosted at Chicago Home Show

Concrete masonry, concrete roofing tile, and concrete architectural stone were effectively presented to the visitors to the "Own Your Own Home" Show in Chicago, during the week ending April 3, by producers of those materials. The general idea of the concrete masonry and stucco home was demonstrated by a leading cement manufacturer.

The dominating exhibit in the main hall consisted of the facade of a Hydro-Stone house with a roof of Hawthorn concrete tile. This joint exhibit of the Hydro-Stone Corporation and the Hawthorn Roofing Tile Company, both operating in the Chicago district, presented in an unusually effective manner the attractiveness and other virtues of good honest concrete construction, and its adaptability to the construction of the small home. The six room bungalow illustrated by the facade is to be built in one of the finest suburban residential sections by a leading contractor, at a cost that will be under $11,000. The roof is of colorblend Hawthorne tile in red, yellow, and brown. The Hydro-Stone will be a rich cream.

The Lehigh Portland Cement Company had a booth in which plans were shown of the demonstration homes now being erected throughout the country. Several attractive panels of modern portland cement stucco proved very interesting to the visitor. Two of the prize-winning homes were shown by small models built to scale.

Fireplaces, birdbaths, garden furniture, and other ornamental concrete products, in caen stone and other finishes, were shown by the Architectural Decorating Company and the Hartmann-Sanders Company. These, too, proved quite interesting to the many homeowners visiting the show.

This concrete home was shown at the Chicago Home Show.

Exhibits such as these are quite worth while. The products manufacturer and the builder of concrete homes should not neglect similar opportunities to demonstrate their work.

The Year's Program of the Concrete Products Association

In spite of the limited funds available for association purposes the Concrete Products Association is embarking upon a very ambitious program for the present year. The plan of work includes a great many things that are very important to concrete products manufacturers, and with the co-operation of the state and local associations and the active support of individual members throughout the country, this program bears promise of bringing great benefits and further prosperity to the industry.

According to an announcement from the office of the secretary, D. R. Collins, 47th and State Streets, Milwaukee, the following things will receive the attention of the organization this year.

1. *Production of Quality Products.*—To improve and maintain the quality of concrete products by a practical application of laboratory methods to plant operation. Not only is it intended to increase quality, but in so doing, reduce production cost.

2. *Merchandising and Advertising.*—To assist in every way practical a greater distribution of our products by the application of modern methods of merchandising and advertising.

3. *Law Enforcement.*—To work with proper officials, both state and local, to see that proper legislation is enacted and enforced making possible the use of only quality products in masonry construction.

4. *Education.*—To educate not only the building public but our own members and employees, in the use of our product and in the various steps we have taken to control its quality.

5. *Insurance Rates.*—To conduct a vigorous campaign for equitable insurance rates on concrete masonry construction.

6. *Freight Rates.*—To secure just and equitable freight rates that will allow a greater expansion of our present markets.

7. *Publicity.*—To secure, wherever possible, proper publicity on the work of our association and its members through national and local publications.

8. *Home Construction.*—To, wherever possible, put our product in buildings "above the grade," particularly in the line of home construction.

9. *Large Building Construction.*—To work with architects, contractors and builders to include concrete products in specifications for factories, warehouses and public buildings.

10. *Affiliation with National.*—To prosecute a vigorous campaign for new members for the organization of state and local organizations fully recognizing that in unity and members there is strength.

It is hoped that every member of the Products Association may bring his product to such a quality during 1926 that he may receive the official Certificate of Quality from the association. This is an extremely important thing and has proved very effective in many places in promoting the sale of concrete products where otherwise they would not have been admitted through specifications.

Turning Culls into Good Face Block

George J. Saffert Salvages Chipped and Porous Block and Tile, Turning Them into High Grade Faced Units, by Means of a Machine of His Own Invention—Sales Made on a Quality Basis Under Name of Artstone—An Outline of His Line of Products

Imperfect concrete units, if they are structurally sound, never see the scrap heap in George J. Saffert's plant at New Ulm, Minnesota. They are merely placed into a machine that he has invented, and are rapidly turned into perfect and strong face block that bring a fancy price. The production of faced units is not limited to the culls, however, since there is a demand for ornamental units that is so great that faced units have become one of the main products of his plant.

The machine invented by Mr. Saffert to be used in applying the facing to a concrete block or tile is one that clamps the hardened unit securely in a frame, with the face held the thickness of the facing layer below its rim. Upon application of the facing material the unit is stripped upward, the holding frame opens, and the unit is ready for removal to the kilns. The first step in the process, after the unit is clamped in the machine, is to brush a heavy coat of grout over the surface to be faced. This grout is a creamy mixture of cement and water. The facing layer, of special aggregates, mineral pigments, cement, water, and a waterproofing compound, is then put into the mold and firmly trowelled onto the surface of the unit. The upper edges of the holding device, or mold, act as a guide to insure an even and plane coating of the desired thickness. The required texture is then secured, and the unit, as soon as the facing has properly set, is released and placed on the rack. The releasing is done by means of a lever, which first lifts the product sufficiently to cut the edges of the facing to exact line, thus avoiding the injury that is usually to be expected when a mold is pulled away from a unit, and the holder is then opened by means of another lever, releasing the unit.

High Quality Maintained

Only the best of mineral pigments are used to gain the desired colors, and selected aggregates are frequently relied upon to aid in the color scheme. Faced tile and block are made on a piecework basis. During the past summer two men were kept at work doing this facing operation, and the rate of production averaged about 140 an hour. Not one second or cull was produced during the entire season, even though many of the units so treated were originally rejects from the block and tile machines.

The Saffert plant, in which are made such things as plain and faced Zagelmeyer block, plain and faced tile, plain and faced Duntile, watertable block, concrete brick, silo staves, drain tile, door and window frames, concrete monuments and gravestones, well curbing, culvert pipe, cistern tops, chimney block, pier block, window sills, window caps, inscription plates, lawn vases, bird baths, concrete steps, wall coping, and other precast concrete units, is divided into departments, each turning out a particular class of work. Each department is practically a complete plant itself with its aggregate and cement stock, mixer, machines and molds, and rack cars. Everything power driven is operated by electricity. One Duntile machine, two building tile machines built by Mr. Saffert, and Zagelmeyer cars for cast block, constitute the equipment of the block and tile departments. An elevated hopper, on tracks, furnishes the aggregates to the various machines. Aggregates are hauled from pits in the vicinity and are washed and graded at the plant before going into storage. Everything possible is handled mechanically in order to promote low manufacturing costs and quantity production.

Two Days in Kiln

After the units have been made, they are placed in the steam kilns, where they must cure for at least 48 hours, and are then neatly stacked in the yard to remain for the remainder of the curing period and until called for. Deliveries are made by truck and rail, and are distributed over a fairly wide territory. An office is maintained in Minneapolis for convenience in handling orders that are to be delivered to buyers in the Twin Cities. Tests at the University of Minnesota have shown that 5x8x12 building tile made in this plant will develop a strength of 158,600

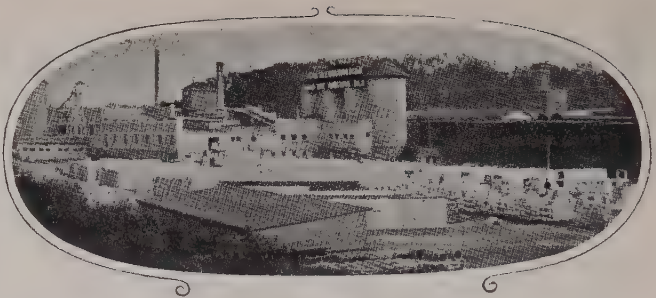
Here is the unique trademark adopted by the Saffert concern, and used on their letterheads and all literature. Trademarks that are well designed and easily recognizable are great aids in selling quality products

One of the many designs for Artstone monuments as produced by the same concern. They are advertised as being the equal of any stone, and as possessing exceptional beauty and durability lbs., or over 1600 lbs. per sq. in. of gross area.

Mr. Saffert is a great believer in his own products. He specializes on selling concrete masonry and merchandising a quality product. With him, a concrete unit is not a substitute for something else, but rather it is a better material that will make a better structure. His concrete brick sell for a great deal more money than do clay brick, and rightly so, since they make a far stronger and more permanent wall. His Artstone Material is advertised as a product of a "concrete specialist"—note the name! The products are sold through dealers, or direct to the builder, and are becoming known among architects as being highly satisfactory. For the convenience of the trade, the firm carries a line of reinforcing bars, marble and granite facing aggregates, and wall ties. Dating from 1909, this concern has been responsible for a great deal of good concrete masonry construction, both rural and city. The goodwill created by good work has aided materially in the growth and the success of the business.

The facing machine perfected and used by Mr. Saffert is available to other products producers, since he has expressed his willingness to license a few other plants and furnish the machine.

A partial display of Artstone, showing a few of the surfaces produced in the New Ulm plant



View of the plant and stock pile of the Saffert Cement Construction Co., with Ribstone aggregate silos, the staves for which were made at the same plant

Concrete to Play Part in Proposed Japanese Reconstruction

Buildings of temporary character erected in Japan within the immediate few weeks or months after the 1923 earthquake are as permanent as those which they replaced, and will probably be in use for a good many years, according to a report to the Department of Commerce from Acting Commercial Attache A. B. Calder, Tokyo. The larger part of the burned areas of that city has been rebuilt with these so-called temporary buildings, both for residential and business purposes.

The government's program of reconstruction is spread over several years, and includes roads, streets, bridges, sewers, canals, the erection of its own departmental buildings, and property adjustments with land owners whose holdings are affected by changes in street widths, directions, etc.

Merchants along the Ginsa, the main shopping street of Tokyo, have had under way for some months a plan for constructing permanent buildings along this thoroughfare in accordance with the regulations of the Reconstruction Board.

Since only fireproof buildings are to be permitted along this thoroughfare, merchants and property owners who have put up temporary structures will be obliged to secure financing before they can tear the temporary buildings down and erect the more costly type of permanent building required. It is doubtful as to when the government will require removal of the temporary building and construction of fireproof buildings.

When the erection of the latter begins, there will probably be a demand for the type of lumber used for forms in reinforced concrete work, since concrete will probably be used for these buildings.

Novel Expansion Joints in Berlin Concrete Pavements

Dr. Eng. Klose of Berlin in Zement, Sept. 3, 1925.

Abstracted and Translated by
E. LEE HEIDENREICH

Fig. 1 shows a cross section of a concrete street pavement, built of 1:4 concrete and covered with ⅜" of "steel concrete" which consists of high aluminum cement and iron dust, similar to our Ironite.

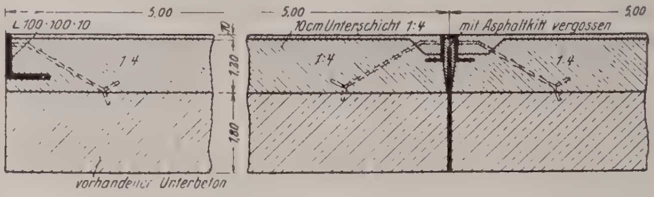


Fig. 1. Cross Section of Pavement with the expansion joint in position.

The above pavement is supported by a 7" concrete layer of 1:8.

The expansion joint consists as is shown in Fig. 2 of two Z-bars cut in zig-zag form so as to fit into each other to obviate wear and tear by and to vehicle wheels.

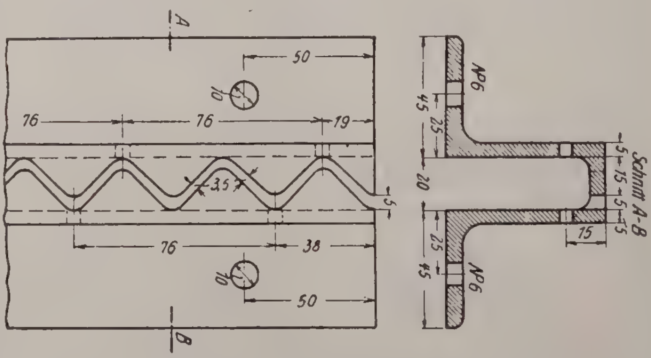


Fig. 2. Details of The Expansion Joint

The Z-bars are anchored every 8 or 10 ft. into the 1:4 concrete.

Safety in the Use of High Explosives

Things Worth Consideration by the Contractor Who Has Any Rock to Move—Safety Measures That Will Protect the Men and Increase the Efficiency of the Work

By LIEUT. COL. GEO. R. SPALDING
Corps of Engineers, District Engineer, Louisville, Ky.

In the memory of all of us there was a time when this paper might more appropriately have been entitled, "Dangers in the Use of High Explosives."

That we can speak today of *safety* in the use of high explosives is a great tribute to the intelligence of modern industrial management.

Without compulsion of law but in close voluntary co-operation with government and with the using industries our great powder manufacturing companies have labored unceasingly and with success to produce dependable explosives; reasonably safe to store, transport and use—and not content with this they have built up a corps of instructors and a reliable library of well written, fully illustrated pamphlets to teach us how to use and handle them.

In 1906 without compulsion of law the American Railway Association organized the "Bureau for the Safe Transportation of Explosives"; borrowed an officer of great ability, Colonel B. W. Dunn, from the Ordnance Department of the Army to head the bureau and when, as a result, a comprehensive set of regulations were drawn up to govern the packing, marking, loading and transporting of the explosives, seventy-eight American and Canadian Railways, operating over 130,000 miles of track, at once adopted and enforced them.

Later came the Federal Law and the regulations of the Interstate Commerce Commission—which now govern all railroads and all shippers. But the law, different from most reform laws, came naturally and as a result of pioneering by industry. It is, therefore, accepted by all and enforced by all. Indeed the railway companies and powder companies are the law enforcement agencies in fact if not in name.

And now we find the great users of explosives, mining, quarrying, cement and construction companies joined together and with the manufacturing companies, as members of the National Safety Council, to interchange experiences with a view to insuring a greater degree of safety in the use and handling of explosives on the job.

Safety the Direct Responsibility of Management

Such a story of intelligent and continued interest in safety measures on the part of industrial organizations is strong evidence that the welfare of the public and of the workers are safe in the hands of modern industrial management.

Not because the management is altruistic—but because it is intelligent and knows that no industry can grow into greatness or long endure which unduly threatens the safety of the public or neglects the welfare of its own workers. Fully realizing this, the highest officials of the explosive industry are the vital, moving spirits behind all our safety measures. They know that the success of their industry depends upon our knowing how to use their products safely and yet economically.

Just as truly no operation in which the handling or use of explosives plays an important part can be successful unless the management thereof sees to it that the public and the workers are safeguarded.

The interests of the users of explosives are identical with the interests of the manufacturers. In all our problems, therefore, we will find the great leaders of the explosive manufacturing industry and their experts, our best advisers and next friends.

I am not an expert in high explosives. It has been my great privilege, however, to be charged with the management of some rather large affairs, both in peace and in war, in which the use of high explosives played an important part.

The one outstanding lesson which this experience has taught me is that the man who is the managing head—the man who is responsible for the success of an operation involving the use of high explosives—must be held personally responsible for the adoption of and enforcement of suitable safety measures.

The attitude of the Big Boss must be a correct one and the superintendents, overseers and foremen serving under him must know that their Chief is as interested in safety as he is in production and in economy, and that he will hold them accountable for safety just as he holds them accountable for production and economy.

Safety a Part of Operation Plans

In other words, the plan for safety in a job which involves the use of high explosives is not a thing apart to be considered only as it does not interfere with other things. It is a vital part of the plan of operations. With the risk of appearing somewhat didactic, it is believed that to insure safety a manager must:

First—Study the layout of the entire operation; the conditions surrounding the blasting field, the proper coordination of blasting with other operations; and prepare a plan for the entire explosive operation as far ahead as may be possible.

Second—Adopt the policy of using such explosives and accessories as after thorough investigation and expert advice are found to be the most suitable and most dependable for the work, *regardless of first cost.*

Third—See to it that all men are thoroughly instructed and that all materials and accessories are in first class condition. Do not neglect tests and in large operations have them made under expert supervision.

Fourth—By rigid discipline require that the work be executed as planned and in accordance with rules and cautions for safety.

The importance of considering safety in the original layout of a work is well illustrated by an example drawn from a large construction operation with which I am acquainted.

One section of the work consisted in part of the excava-

From a paper read at a recent meeting of the National Safety Council.

tion of a cut in solid rock some 700 ft. long, 60 ft. wide and from 30 to 50 ft. deep.

Near and more or less parallel to this cut was a bench at the grade of the main rail line of the works, which could be and was easily widened by dumping the overburden from the cut.

This bench and fill supplied what must have appeared at first to be an ideal location for the general shops—and so the main boiler shop, machine shop, blacksmith shop and carpenter shops were located thereon. The shops were out of the way of the excavation and convenient to the job as a whole—but they were not out of *blasting radius*.

As a result, unusual and unduly expensive precautionary measures had to be taken throughout the life of the job to protect the men working in and around the shops. As far as possible, blasting was done at meal hours and during change of shift but the character of the rock was such that much secondary blasting was necessary to allow steam shovels to proceed. The danger whistles for these secondary blasts stopped work in and around all shops for periods of five to thirty minutes.

Finally, to reduce this serious and costly interference with shop work, it became absolutely necessary to adopt city methods, and use mats to keep the splinters down.

The safety of the men was secured but at great and unnecessary cost. The shops were general shops and need not have been so near the works. Had safety been considered in layout the shops would have been located at a safe distance. Had this been done, production would have been greater and shop costs less and also rock excavation would have proceeded more expeditiously and at less cost, relieved as it would have been from the necessity for unusual and special precautions.

Safety in a Blasting Plant

Secondary blasting is a very frequent source of injury from missiles, due to the fact that less attention is ordinarily paid at such shots, but more because they throw further than the larger, better decked shots.

A source of injury on construction work, which is frequently overlooked and which must frequently cause trouble in all quarry work is that of falling rock from overhangs.

Both overhangs and large lumps which require secondary blasting can be eliminated by a careful study of the spacing and loading of holes.

In the past, in most construction jobs and quarry jobs, the location of holes and the amount and character of loading was left to practical rockmen or quarrymen whom from long experience in a particular locality, seemed to be able to judge almost at a glance the proper amount of explosive to use and the proper way to space the charges to secure desired results with safety.

They *seemed* to be able to tell at a glance, but as a matter of fact it was their local experience and the methodical, careful records (mental records only, in many cases) which they kept of past shots and past results, which enabled them to do well what other men would do badly.

Can Not Depend Upon Such Men

Modern quarry work, and modern construction excavation cannot depend upon such men. There are too few of them. Indeed in many localities where new quarries are opened, there are none at all to be found.

Our military experience—particulary our experience in mining operations against the enemy—has taught us that large blasts must be carried out in accordance with carefully reconsidered plans—just as is done in any large engineering project.

In such plans, the location and size of all charges are determined by calculations which are every bit as reliable as those used in the design of foundations for engineering structures. Indeed, because of the more frequent opportunity to test calculations by results, they become more reliable as the work proceeds.

More and more are similar scientific methods being used in our large quarry and construction operations. The computations are not difficult and the data upon which they may be based is available to us all in the forrm of tables furnished by the explosive manufacturers.

The data in these tables is, of course, for average conditions, and particularly is this true in the amount and character of explosive required per cubic yard of rock, and so judgment must be used at first. But, if, as the work proceeds, surveys are made before and after each blast, it will not be long before recorded experience will enable one to determine loading and spacing with a great degree of accuracy.

To make a survey and sketch of the crest and toe of the quarry face, to locate thereon the line of holes, to drop a few plumb lines down from which to determine the thickness of rock between face and line of holes; to keep careful record of the loading of each hole and then after the blast to record results at the crest, and after excavation to record results in the face and at the toe, and to keep a special record of the line of flying missiles, seems like a formidable and unnecessary task before it is undertaken, but such methods will reduce secondary blasting, eliminate overhangs, cause fewer injuries from missiles and also, I am convinced, pay handsome dividends on the cost.

Safety in the Choice and Purchase of Materials

There has been a tendency in the past and, to a degree it still exists, to look upon blasting as a dangerous occupation; in which occasional injuries and fatalities are inevitable, and but part of the "risk of duty" which men who are men must take, and are proud to take. With such an attitude I have no quarrel. Civilization advances only because there are men, always have been and always will be, men who think more of duty than of life.

But neither in war nor in peace should such men be called upon to risk limb or life unnecessarily.

For almost every condition to be met in the blasting field today there are explosives and accessories which will permit the work to be done with reasonable safety. And it is incumbent upon management to see that only those most suitable and safest are purchased, that they are kept in safe and usable condition at all times, and made available to the men as needed.

In an early experience in the Philippines, I was charged with the construction of a road in a side hill partly in solid rock. To do the work I had a few engineer soldiers, a quantity of native labor, and a group of some twenty military prisoners, two of whom wore the ball and chain.

One day as I passed the corporal in charge, he called to me, "Lieutenant! We're going to have a rotten accident on this job; I can't keep the loaders from tamping with drills; they are ordered to use wooden sticks but there are none around—and I hate to hold up the work." He took me to a hole where a prisoner was making the sparks fly in the flinty rock as he tamped.

I got the wooden tamping sticks and learned a lesson which I have never forgotten.

"Don't expect men to obey safety rules unless you make it possible for them to do so by supplying them with suitable equipment."

Misfires Most Frequent Cause of Accidents

I think that, by and large, your experience will agree with mine that the most frequent cause of accidents on the blasting field is due to misfires.

Misfires come from a variety of causes.

In electric firing the most frequent appear to occur when the shots are wired up in series as is necessary when a number of holes are to be fired by a blasting machine.

At Muscle Shoals a blasting foreman reported that since beginning use of a new supply of detonators, he was having too many misfires. He was satisfied in his own mind that the detonators were defective and recommended that the entire lot be discarded and a new lot purchased from the manufacturer who theretofore had been supplying satisfactory caps.

To settle the "morale" situation, this was done but in justice to the manufacturers of the discarded detonators, they were asked to send an expert to look into the matter.

After a careful investigation, it was found that while the resistance of the discarded detonators departed somewhat more from the normal than those which had been used before, all were within reasonable limits and that the real trouble lay in the fact that the blasting machine, due to wear or improper care, had failed in power. The substitution of a new and stronger machine helped but did not overcome the difficulty.

A similar experience was met with in the construction of Lock Number 1 on the Monongahela River where the use of a stronger machine, and detonators of greater power (No. 8 in place of No. 6) corrected the trouble.

After similar trouble with electric blasting machines on the fire power house excavation at Muscle Shoals, it was decided to resort to firing from the power circuit, connecting charges in parallel.

At Panama, a "number of accidents results from steam shovels coming in contact with unexploded charges, which led to an investigation of the fuses and the results obtained from various methods of firing. Previous to that time charges were exploded by a blasting machine, and investigation showed that failures were liable to result when this type of machine was used. Experiments were then made by using the current from the lighting plants distributed along the east side of Culebra Cut, and it developed *that while misfires occurred where the fuses were connected in series, there were no misfires when connected in multiple arc.* As a consequence electric conduits were laid from the various power plants into the Cut, distributed lengthwise through it within easy reach of the areas remaining to be excavated, and thereafter all holes were exploded by means of current from the dynamos."

There is an inherent difficulty with series firing which cannot be overcome in the present state of the art of cap manufacture. In spite of honest effort by the manufacturers the resistance of caps to the electric current varies and when a number are connected in series, those in which the resistance is the greatest, heat up and fire first, breaking the circuit so that the others cannot fire.

Difficulty Remains Even Under Good Conditions

Special care in making connections, the testing of all caps and of machines and circuits before firing and the use of stronger blasting machines will serve to reduce misfires but even with good conditions, the inherent difficulty mentioned is not overcome.

Where a large number of holes must be fired simultaneously, they should be connected in parallel and fired by current from a lighting or power line. For this purpose direct current is preferable but an alternating current of sixty cycle frequency is satisfactory.

Of course, even in parallel connections, misfires may occur from defective caps or bad connections, and tests of caps and of circuits must not be omitted.

To reduce misfires still further Cordeau-Bickford may be resorted to. This type fuse has long been known and used in the military service. This fuse is a lead tube of about ¼-in. diameter, filled with T.N.T. It is safe to handle, safe to ship and safe to keep, and yet it detonates with such great rapidity as to be practically instantaneous for reasonable lengths.

In military demolitions it is often necessary to drill and load a bridge or other structure with explosive and then await the proper tactical conditions. Nothing is of value in such work which may be injured by delay.

By the use of Cordeau-Bickford a number of charges of compressed T.N.T. or other stable explosive may be connected up and kept under guard in readiness for firing. When the time comes for firing, all that is neccessary is to attach an electric cap to each end of the Cordeau and fire with a blasting machine.

Fuse Being Used To Considerable Extent

This fuse is now being used to a very considerable extent in the quarries of our large cement companies. I am confident that before long it will be used in all quarries where well drilled holes are used.

In loading the well drill holes, the end of the Cordeau is tied to a cartridge; this is placed in the hole, and the Cordeau is run off the spool until the cartridge touches bottom.

After the hole is fully loaded, the Cordeau is cut off a little above the collar of the hole. When all holes have been loaded, they may be connected by a trunk line of Cordeau with an electric cap at each end or an electric cap may be connected with the Cordeau extending from each hole and the various caps connected by wire and fired in the usual manner.

The use of Cordeau by keeping the electric circuit above ground in the dry where bad connections and short circuits can be avoided or easily found by tests and corrected, practically eliminates all chance for misfires. In addition, it eliminates the necessity for making up primer cartridges, a proceeding always attended with risk, and allows the first cartridge to be *lowered*, not dropped, into the hole.

All in all, it is the safest means known for detonating the charge in well drill holes. I am led to believe, also, that in spite of its rather high cost, it is a cheaper material than caps because it permits the use of a higher cartridge count explosive. As to this, I do not know, but I do know that it is *safer* and therefore more economical when the job as a whole is considered.

Safety Instruction and Safety Discipline

With a good layout plan, a good blasting plan, a proper co-ordination between explosive operations and other activities in the vicinity; with good materials and the most suitable equipment, there should be few accidents in the use of high explosives, provided the men engaged in such operations are suited to the work, are properly instructed in their duties and responsibilities and imbued with a proper sense of safety discipline.

Regardless of other qualifications, there are some men who can not be trusted to handle or use high explosives with safety.

Natural awkwardness, timidity and absentmindedness are characteristics as much to be feared as bad habits and recklessness.

The personal characteristics of men can only occasionally be discovered before trial.

Safety, therefore, demands that all operations must be as nearly fool proof as it is possible to make them and because it is impossible to make them absolutely fool proof it is necessary that the men engaged, and all explosive operations all the way from receipt of materials, through care and transportation to final use, be under the supervision of a competent and careful head, who, if he be not an expert in explosives and electricity, must have ready access to the advice of such experts.

Such a man, supervisor of explosives if you wish to call him that, will co-ordinate the selection of the men, their training and their discipline in a manner to insure that proper methods are used and proper precautions taken.

But he will *also* keep abreast of the developments in explosives and explosive accessories and in touch with the history of accidents and their causes with a view to eliminating similar causes from his own work.

He will not be satisfied with a mere printed list of rules and cautions but will investigate the reasons which brought about their adoption and be prepared to develop and issue new instructions which carry the weight of his own authority.

Premature Explosion Resulted in New Rules

The premature explosion which occurred at Bas Obispo, Panama Canal, in December, 1908, which resulted in the death of 23 men and the injury of 40 others is an example which leads to the development of new and living rules—

"Fifty-three holes had been drilled and sprung. Too prompt loading after springing had caused an earlier premature explosion, due to the heat in the holes and therefore 48 hours was allowed to pass before loading was begun.

"A total charge of 44,000 pounds of 48 per cent dynamite was then loaded, the fuses set, and all holes tamped before any connecting wires were strung. This latter precaution was taken because an earlier premature explosion had resulted from a current induced in the connecting wires. As the last hole was being loaded the explosion occurred.

"It was a clear day, there was no lightning, and the dynamos from which firing current was to be had were not even running. While the cause of the accident was never positively ascertained, it developed later, when the water in the bottom of the holes was chemically examined, that it was sufficiently acid to attack the dynamite cartridge and liberate the nitro-glycerin.

"A *secondary blast* had been fired just across the Cut from where the explosion occurred and it was assumed that the free nitro-glycerin in some of the holes detonated from the jar of this secondary blast, and as all the remaining dynamite charges were connected with fuses, the detonation of the entire lot followed.

"As a consequence, instructions were issued that no loading operations would be undertaken in any area that could not be completed and fired the same day."

A History of Mistakes

Personal experience is a harsh schoolmaster. It is pleasanter *and cheaper* to learn from the experience of the past than from our own disasters. I find there is much literature on the use of high explosives; some of it of great value. A real living write-up of disasters and mistakes in quarries and on construction jobs would carry the lessons of the past home to us as no other method except personal disaster or mistakes can do.

Some Tarpaulin Facts That Are Worth Knowing

Many contractors have, in their search for bargains, found themselves owning a set of tarpaulins that gave but indifferent service. They get torn by the wind, ripped on projecting nails or let in the rain on several loads of cement. The bargain soon proves no bargain at all, but a rather expensive proposition. The wise contractor soon learns that the low cost and economy do not always go together when it comes to paulins, any more than with many other items of equipment.

Paulins should be purchased according to the duty that they are to perform, but ordinary job conditions generally require ability that is only found in the canvas that is of high quality. The economy usually will be found to outweigh any price difference.

Tarpaulins are furnished in white untreated, or in colored treated materials. The materials which are furnished in these generally consist of the following ducks: Single filled duck, with one thread in the warp and one in the filling; double filled duck, with one thread in the warp and two in the filling; and Army duck, which consists of twisted thread, making a cord both in the warp and in the filling. The weights are specified per yard for each width and the paulin materials are furnished in various widths as follows:

29 inch goods, weight based on width of 29 inches;
36 inch goods, weight based on yard of material, 36 in.
40 inch goods, weight based on yard of material, 40 in. wide.

With this being the case, it is best for the contractor to specify both weight and width in ordering. The order should thus read somewhat as follows: "One paulin, 14x 16 ft., made of 36 in. 8 oz. duck"; 40 in. paulins of a given weight should be priced at a lower figure than the 36 in. goods, while the 36 in. paulins should be less expensive than those made of the 29 in. material.

It is also advisable, when purchasing, to specify the weight of the duck before treatment, for some have found, when their order did not specify weight before treatment, that the desired 12 oz. duck turned out to be nothing but a 7 oz. duck loaded up with waterproofing until it weighed the 12 oz. The specification should then read somewhat as follows: "One paulin, 16x20, waterproofed, made of 12 oz. single filled duck, 29 in. width, before treatment," or it might be worded similar to this: "One paulin, 14x 18 ft. made of waterproof treated duck, 10 oz. double filling 29 in. width, before treatment." If the contractor always specifies in this way, he will receive, from reputable firms, the article that he should have, and an article that will give him real service.

Paulins for small trucks, such as the Ford, and for similar use, may be of waterproof treated material, weighing 7 oz., 29 in. wide, before treatment, but paulins larger than 10x12 ft. should be made of heavier material.

One type of tarpaulin, recommended as quite suitable for use on the job, is made of 12 oz., 29 in. double and twisted filling material, treated with waterproofing on both sides. This type of paulin has sufficient tensile strength to stand pulling and hauling over rough lumber, over sharp cornered boxes, and it should well resist mildew or other rotting which may be induced by lime or cement or plaster, and so on, and it will give good protection against water.

The contractor should have his name on his paulins, in large letters. This will help advertise his work, and be a deterrent to those who might steal the canvas or approximate it for some other use.

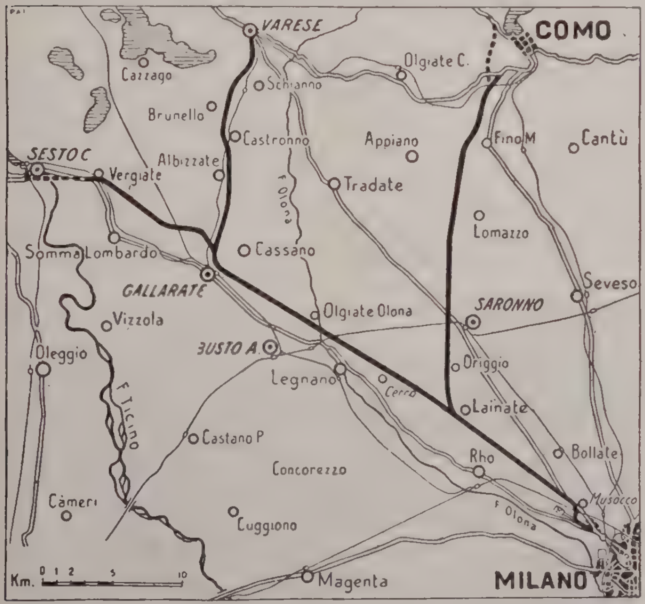
Tarpaulins are useful, of course, in enclosing concrete work during cold weather, but it should be realized that they are just as valuable for covering concrete in hot weather so that hot winds will not rob it of the moisture needed during the curing process. Another important and well known use is for covering newly-placed concrete in case of a sudden shower, since the rain will easily pit a newly-finished surface and thus necessitate refinishing. Contractors are familiar with the use of tarps to protect materials such as cement, that would otherwise be ruined by water, and are constantly using them to good advantage to protect equipment when not in use. An untreated canvas, soaked in water, will be found to be of great value in preventing too rapid drying of stucco or other exposed concrete work where hair-checking is to be avoided.

The New Automobile Road in Northern Italy*

The first automobile road in Italy was recently completed and opened to traffic. It was built by a private concern, Piero Puricelli, in Milan. This concrete road net—totaling about 53 miles—extends from Milan to the picturesque lakes of Lombardy. The main road—Milan to Gallarate—is 20.5 miles long. It is a toll road for automobile and truck traffic only, with lines of barbed wire fence along the sides and no grade crossings. No smaller vehicles or pedestrians are allowed to use this road. The toll amounts to about one dollar per vehicle. As the average daily traffic number 600 vehicles, this represents a daily toll of $600.

In planning the location of the road, it was desired to facilitate the maintainance of a relatively high speed of traffic. To this end, straight courses were adopted, whereever possible (up to 11 miles long), smooth curves were used (with the exception of four, the radii were greater than 1,600 feet) and a maximum grade of 3% was specified.

Considerable earthwork had to be done, including fills of 50 feet and cuts of 72 feet. However, the alluvial soil forming the moraines of this region, facilitated the work. All grade crossing were eliminated.



The new concrete highway, operated as a toll road, that connects Milan with three cities to the north, is shown on this route map.

An American paver and finishing machine at work on part of the project.

American methods of construction and American equipment—mixers and finishers—were used throughout. A foundation course—about 6 in. deep—of coarse beach pebbles was followed by the concrete service course. Expansion joints—about 1 in. wide—were spaced 30 feet apart at an angle of 30° to the road axis.

A 1-2-3 mix was used. Five American mixers permitted a maximum daily output of 7,189 sq. yd. of road surface in a ten hour day (not including the tar coat). The entire program comprised 840,000 sq. yd. of concrete surface laid with 81,000 cu. yd. sand, 157,000 cu. yd. coarse aggregate and 500,000 tons cement.

The number of bridges was increased by eliminating grade crossings. With the exception of five, all bridges were of reinforced concrete. The larger structures included 51 spans of 25 to 150 feet and one tunnel 230 feet long.

The work was begun in June, 1923, and was completed in September, 1925.

Highway Traffic Problems Discussed at New York Meeting

Highway traffic problems, so thoroughly intertwined with highway construction problems that the two are hard to separate, were thoroughly discussed at the annual meetof the National Highway Traffic Association, which was held at the Automobile Club of America, in New York City, on April 30. Addresses delivered by national authorities at that session covered such subjects as the trend of motor vehicle legislation, the synchronous utilization of highway transport and railroad transportation, metropolitan traffic control, traffic planning in municipalities, the high cost of bottlenecks in highways, high speed highways, illumination of highways, aerial photography as an aid in traffic surveys and highway safety promoted by adequate brakes on motor busses and trucks. Speakers of national importance were present, among them being David Beecroft, of the National Highway Traffic Association; Prof. Lewis W. McIntrye, of the University of Pittsburgh; Prof. Arthur H. Blanchard, of the University of Michigan; G. E. Hamlin, of the Connecticut State Highway Department; Ernest P. Goodrich, Col. I. C. Miller and others. Committees reported on the regulation of pedestrian traffic, signal systems for the control of traffic at street intersections and other matters.

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*Abstracted from article by P. Thorz in "Der Bauingenieur," *Dec. 4, 1925*, by Margaret Arronet, 1951 West Madison Street, Chicago, Ill.

Patching Concrete Pavements

A Review of Methods in Use — Recommendations for Making Good Patches — Many Communities Cut and Patch Concrete Pavements Successfully

An article describing a patented method of patching concrete pavements, published in the March number of CONCRETE, has been received with a great deal of interest and has brought several letters to the editors commenting on the various methods of patching and maintaining concrete pavements now in use. This subject is of particular interest at this time when spring maintenance is under way and when utility companies are cutting through pavements to make repairs to underground structures. In this article CONCRETE presents to its readers the experiences of engineers in replacing cuts in concrete pavements and in patching and maintaining concrete pavements.

Many engineers in various parts of the country have developed simple, unpatented methods of patching that have been entirely satisfactory. In fact, patches that have been under traffic for several years have been so perfectly made that it is difficult to find them without close inspection. Methods in various localities are strikingly uniform. Usually the replacing of cuts made by utility companies and the repairing of broken places in concrete highways is done by the city or county maintenance forces with their own labor and equipment.

There is nothing difficult in making such patches. It is only necessary to adhere strictly to the commonsense principles of making good concrete for any structure. Only a few tools are needed to make the repairs—a hammer and chisel, tamper, hand float, shovel and small mixer. Cement and aggregates are the only materials required. The work can be accomplished by relatively unskilled labor under the direction of a competent foreman.

It is important that all loose particles of concrete be removed from the broken section or from the cut. Care must be taken in removing the old concrete so that no radial cracks remain. The patch will always look better if it can be made of some regular shape, say round or rectangular. Acute angles in the patch area must not be permitted.

First cut out all old material, and chip down the edges of the slab to a vertical surface for at least one inch below the top.

When the old material has been cut out, the subgrade and the edges of the good concrete must be thoroughly wetted down.

The edges around the cut are trimmed to a vertical surface for a depth of about one inch below the surface of the pavement. This permits the finishing of the patch without a slope or feather edge at the wearing surface and prevents spalling around the edges of the patch. Below this trimmed edge the jagged walls may be allowed to remain just as they were cut out. The edges of the cut must then be carefully cleaned of all foreign material with a stiff brush and they must be thoroughly wetted before concrete is placed in the hole.

Practice varies slightly in the matter of preparing the subgrade in the patching area. In some cases the subgrade is simply backfilled with sound earth to the level of the bottom of the pavement slab and then thoroughly tamped so that there will be no subsequent settling. In other cases the subgrade is excavated to a depth of from four to six inches below the bottom of the pavement and the patch is placed with a greater thickness than the pavement proper. Some engineers require that the concrete in the patch be flared at the edges and that it extend under the bottom of the old

Working the finish coat of mortar with the float. This finish coat is sometimes dispensed with.

concrete slab. In any case, the important feature is to have the subgrade thoroughly compacted.

Proportions for Concrete

While proportions used for mixing concrete for patching are not standardized, all engineers use a fairly rich mix—say 1:2:3, 1:1½:3 or richer. It is usually necessary to open patched areas to traffic with as little delay as possible and because of this it is necessary to follow those practices which will insure concrete of the greatest possible strength in the shortest possible time. Quick hardening depends on (1) richness of mix; (2) freedom from excess water; (3) use of admixtures; (4) proper grading of aggregates; and (6) time of mix. If all these factors are combined, it is possible to make concrete which will attain sufficient strength in two or three days to permit opening the patch to traffic.

The sand selected for this work should be comparatively coarse—90 per cent should pass the one-fourth inch screen. Coarse aggregate should be well graded and should have a maximum size of two inches. In general, stone or pebbles larger than this offer some difficulty in placing and finishing with the dry mix recommended.

For a quick hardening concrete the following proportions have been found to give excellent results: one part cement, one part sand and one and a half parts of coarse aggregate. These were mixed in a batch mixer with not to exceed four gallons of water per sack of cement. A batch mixer is necessary as the proportions used with the low water content will give a concrete that is too stiff for successful hand mixing.

To this mixture should be added two quarts of calcium chloride solution for each sack of cement used. In figuring the amount of mixing water the calcium chloride solution should be included, that is, if a one bag batch is used then the amount of mixing water to be used will be only 3½ gallons. The materials should be mixed in the drum for at least two minutes.

The Indiana Method

In its instructions for repairing concrete highways, the Indiana State Highway Commission gives the following easily understood instructions for using calcium chloride for patching:

"It is imperative that the exact quantity of this material be used in each batch. An excess will weaken the concrete and insufficient amount will not hasten the setting. The calcium chloride must be added directly to the drum as small, undissolved particles remaining in the concrete will cause the concrete to disintegrate. The calcium chloride will be added in the form of a 'Standard Solution' made by thoroughly dissolving one pound of commercial calcium chloride in enough water to produce one quart of solution. (This is at the rate of 2½ quarts of the $CaCl_2$ to one gallon of water.) This standard solution should be placed in a barrel and labeled. Two quarts of the solution for each bag of cement should be added to the mixing water just before it is put into the drum."

Placing and Finishing

As the concrete is placed into the cut it must be carefully tamped. The important feature of a successful patch will depend largely on the thoroughness with which the concrete is hammered into place. It is especially important to tamp it vigorously against the sides and the lower corners. The cut out section should be filled from one-half to one inch higher than the pavement surface. Fresh concrete will not compact the entire thickness on first tamping but repeated tamping will force the material firmly against the walls of the old pavement. Tamping should be continued until the concrete is so hard that the tamper does not mark it and until it can be walked upon without leaving footprints. By this continued tamping the concrete is condensed till practically all the shrinkage is taken up and a perfect bond is secured with the old concrete pavement.

The patch is then finished to conform to the surface of the pavement and cured. As soon as the surface is finished, it should be covered with burlap and kept wet for at least 10 hours. Traffic is kept off the patched area until it is at least 24 hours old. When the temperature falls to 60 degrees, traffic should be excluded for at least 48 hours. In colder weather longer periods must be allowed for curing.

In selling a home builder on a concrete floor don't let him tell you that a concrete floor is cold. If it is off the ground or over a basement it is just as warm as a wooden one—particularly if the space underneath is as warm and dry as the room above. For a little more money you can sell him a fire-safe concrete floor with a hardwood finish floor on top, but the man who lives in the South will know that that is unnecessary.

This concrete patch was successfully made in a brick pavement, and despite heavy traffic it has given complete satisfaction

Here is a patch put down in 1923 which was so invisible that it had to be marked by the photographer.

Hoosier City Has Model Homes

Five Concrete Masonry Homes Built by Indianapolis Bank and Sponsored by a Local Newspaper Demonstrate the Economy of Well Designed Permanent Construction —A Fire Test Staged on the Property—Publicity Given to Fuel Economy—Some Costs of Laying Concrete Masonry

The city of Indianapolis has an enviable reputation because of the unusual civic spirit of its leading citizens, which has manifested itself in the admirable design and layout of the city itself and the character of the enterprises fostered by its business men and commercial association.

In an article in the *Outlook* for January 27, 1926, George Marvin deals extensively with this characteristic of Indianapolis and, among other things, states that the editor of the *Indianapolis News* "and the rest of his staff and the people who read his newspaper get more kick—actually more interest—out of the *News'* Better Building Project than they do out of bathing-beauty contests. He considers his sponsorship of a city plan to provide demonstrations of dwellinghouse and landscape architecture, interior decoration and arrangement, and the practical advantage of ever newer domestic conveniences is a solid investment in civics; by contrast the bathing-beauty idea is bald and free motion-picture, hotel and resort, and personal advertising. One kind of publicity tends to build up, the other shatters, homes. One strengthens the social fabric; the other is a social upset as contagious as other communicable diseases."

Brick veneer being applied to the English house. The reinforced concrete members add to the strength of the structure

An example of this public spirit above referred to, is the construction of five ideal houses by the Washington Bank & Trust Company, developers of the Williams Creek Estates, under plans drawn by Pierre & Wright, architects, the whole project being sponsored by the *Indianapolis News*, and carried out by the cooperation of the best builders, decorators and home equipment furnishers in the city of Indianapolis.

These houses are excellent examples of Colonial, English, Italian, Spanish and French architecture and are ideal from the standpoint of appropriate landscaping, durable and firesafe construction, homelike and economical interior arrangement, to which has been added artistic interior decoration and furnishings and all modern laborsaving devices.

Cinder Concrete Masonry

The fact that concrete materials were used extensively in the structures of these ideal homes because of permanence, firesafeness, adaptability to various styles of architecture, comfort in winter and in summer on account of the high insulation, all obtainable at prices competitive or lower than other less durable materials, makes the Williams Creek Estates Ideal homes project of interest to the concrete industry. All walls and partitions were built of cincrete blocks manufactured by the Straub Cinder Block Company of Indianapolis, and all floors were of reinforced concrete.

A study of present dwelling construction methods made by the architects for this project indicated a tremendous waste. Many hours of valuable labor are expended in put-

The French house under construction. An old type of structure built of modern materials ting together materials that are themselves not permanent and are combustible as well. It was decided, therefore, to make a permanent investment of the labor required to construct these five model houses by using only materials that would endure and would not burn, thus obtaining the desired permanence and firesafeness and adequate insulation for sound and heat.

The accompanying photographs show these houses in various stages of construction. The Colonial, English and Italian houses have face brick exterior walls with cincrete block backing. The Spanish and French houses have stucco applied directly to the masonry for exterior finish.

Fire Test Used

In order to make a vivid demonstration of the firesafeness of this building material, a miniature house, complete as to roof, windows, shutters and doors, was constructed in the same manner and tested by burning a large amount of combustible material in the interior of the house with no damage to the walls nor to the wood rafters and sheathing which were protected by a ceiling of reinforced concrete below and slate above.

The illustrations of this building during and after the fire plainly indicate the success with which this structure stood the intense heat. The report by the engineer in charge of the fire test stated that the fire quickly reached the limit of the pyrometer, 1809°, and probably soon after reached a temperature close to 2200° Fahrenheit. At the end of forty-nine minutes, while the fire was still at its maximum intensity, water under the ordinary pressure used to fight residence fires, was applied, the fire extinguished and the masonry cooled. The interior of the building was not damaged, except for one small place about two feet in diameter on the ceiling where some surface scaling of slight depth occurred.

Coal Saving Data

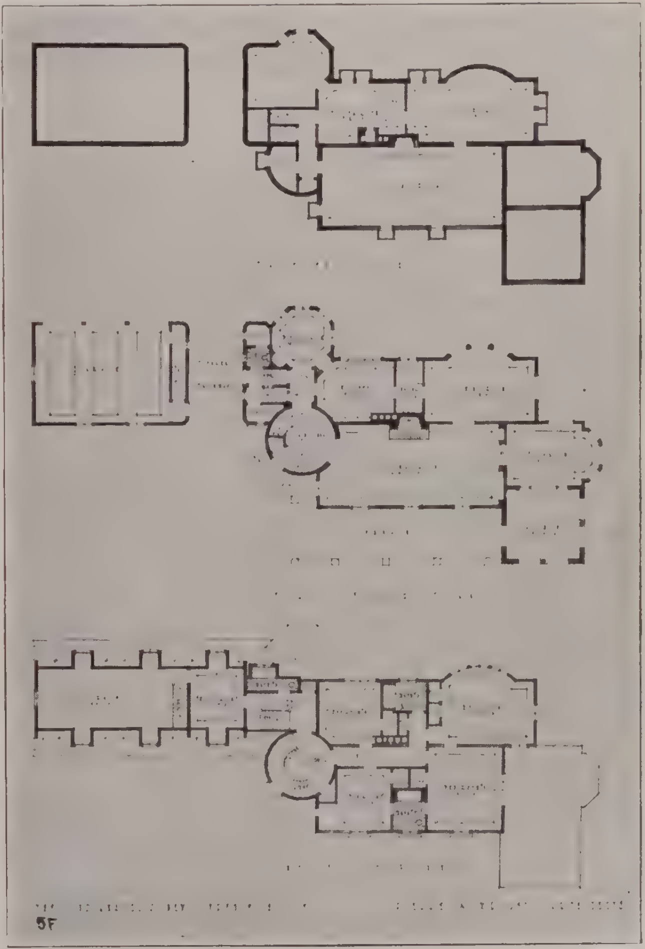
To demonstrate to the public the insulation value of the type of masonry construction used in these houses, the following comparisons of coal required for the heating of buildings of usual types of wall construction were compiled.

One of the stucco houses, with the roof ready for the tile

The same stucco house with the first coat of stucco being applied. Notice the way this coat has been scratched

The exterior wall area through which heat is transmitted in the case of the French ideal house is approximately 3500 sq. ft., exclusive of window and door areas. Were this house located where the heating season is about two hundred days with an average differential of 30° between the air in the house and that outside and, were it assumed that the heating system utilizes about fifty per cent of the heat units in coal as fuel, the following table gives the comparison between the amount of coal required to take care of the heat loss through walls of four types of ordinary construction: (1) frame construction, consisting of clapboard, paper, sheathing, studs, lath and plaster; (2) brick construction, consisting of 9 in. brick wall, furred, lathed and plastered; (3) hollow tile construction, consisting of 8 in. hollow tile, stuccoed on the outside and plastered directly on the inside; (4) standard cincrete block construction, consisting of 8 in. cincrete blocks with stucco on the outside and plastered directly on the inside.

In the table there appears in the first column the thermal conductivity of these types of wall construction; that is, the number of British thermal units transmitted per hour through one square foot of such wall when the difference in temperature between the inside air and the outside air is 1° Fahrenheit; in the second column the pounds of coal required to supply the heat loss through 3500 sq. ft. of given wall through the heating season above referred to; in the third column the excess in pounds of coal required to supply the heat loss through a wall of the given type over



Floor plans of the French house, showing a very unusual room arrangement the amount required for the cincrete wall; and in the fourth column this excess expressed as a percentage of the coal required with a cincrete wall.

			Lbs. of coal per season on account of heat loss thru 3500 sq. ft. of wall		Excess in per cent of loss with Cincrete
Type of wall	Air conditions	Thermal Coefficient	Total	Excess over Cincrete wall	
Wood	Still air	.26	21,800	8,900	69.0
Wood	15-mile wind	.30	25,200	11,200	80.0
Brick	Still air	.20	16,800	3,900	30.2
Brick	15-mile wind	.22	18,400	4,400	31.6
Hollow Tile	Still air	.19	15,900	3,000	23.3
Hollow Tile	15-mile wind	.21	17,400	3,400	24.2
Cincrete	Still air	.154	12,900	-------	-------
Cincrete	15-mile wind	.167	14,000	-------	

From the above it is seen that from 70 to 80 per cent additional fuel is required to take care of heat loss through wood construction, about 31 per cent more with brick construction and about 24 per cent more with hollow tile construction.

Reinforced Concrete

Certain details of construction as found in these homes will interest the contractor. Since reinforced concrete floors were used in all houses it was the practice to cast a reinforced concrete lintel in the wall on the entire perimeter of the building at floor levels. This tied the structure together and should tend to prevent cracks that might otherwise arise from any uneven settlement of the structure that might take place. The same idea was used at the top of the wall, and lintels were also cast over all openings. Sills of face brick added to the appearance of the windows in the Spanish house.

It was found to be an easy matter to apply a face brick veneer over the concrete masonry wall. Flat ties were laid up in the joints at every course, and the veneer was tied to the wall therewith.

Roofs were framed with wood, according to standard practice, then sheathed, covered with roofers' felt, and the tile or slate then laid.

When the site of the development was visited, the work was found to be progressing in good shape. The modern type of construction involved, plus the well worked out architectural treatment of each building, attracted a great deal of attention from the general public. Although the homes are not of the type that could be afforded by the average family, yet the promoters took pains to demonstrate the fact that the same construction could be used with economy in building the small home for the average man.

Although costs on this project are not yet available, other costs, found on similar work performed recently in other cities, may be of interest.

Costs in Another City

The experience of the Fogel Construction Company, Kansas City, Missouri, which is common to that of other builders working with cincrete masonry, is that they find they can save about 10 per cent for plastering on cincrete block over good hollow clay tile. They also find a saving of at least 50 per cent on the labor of placing grounds on cincrete block partitions over any other partition material used. They also state that the labor cost of installing conduit work in cincrete walls is at least 60 per cent less than the labor cost of installing conduit work in brick or hollow clay tile walls, on account of the ease with which cincrete can be cut and channelled.

The following estimate of the comparative cost of 100 sq. ft. of 8 in. wall built of common brick and of cincrete block indicates the saving that can be made by the use of this material in straight wall construction. This estimate is based on the mason's time at $12.00 per 8-hour day and the helper's time at $6.60 per 8-hour day, the mason and helper laying 1000 bricks per day, the bricks delivered on the job at $12.00 per 1000 and portland cement mortar figured at 30 cents per cubic foot.

1273 brick at $12.00 per 1000	$15.28
17 cu. ft. of mortar at 30 cents per cu. ft.	5.10
Mason's time (1.273 x $12.00)	15.28
Helper's time (1.273 x $6.60)	8.40
Total	$44.06

If this wall were built of cincrete block at 20 cents per block delivered on the job and portland cement mortar at the same price as for the brick wall and one mason and one helper laying 200 blocks per day, the cost for 100 sq. ft. of cincrete block wall would be as follows:

112—8x8x16-in. blocks at 20 cents each	$22.40
3.4 cu. ft. of mortar at 30 cents per cu. ft.	1.02
Mason's time (112/200 x $12.00)	6.72
Helper's time (112/200 x $6.60)	3.70
Total	$33.84

This represents a saving of $10.22 for the 100 sq. ft. of wall or 10.2 cents per sq. ft. or a saving of 23.2 per cent in the wall laid. When the entire building construction is considered, the other elements referred to above must be considered.

In the construction of a two-story, 7-room house, with basement and attached garage in LaGrange, Illinois, cincrete block, stuccoed on the outside and plastered directly on the inside, were used. The house was built at a cost of about $14,000, effecting a saving of about $300 over the estimated cost of the building with ordinary frame construction.

Repairing Radiator Leaks With Cement

The contractor who is away from his repair shop is frequently up against it when something goes wrong with a truck or another item of motor-driven equipment. Leaky radiators are often the hardest to repair, especially when none of the usual compound is available or the use of the soldering iron is impracticable. One good way to make temporary repairs on a leaky radiator requires nothing but materials that may be easily found on any job—cement and a strip of rag. The job is simple. Drain the radiator, and then plug the hole with a strip of cloth that has been soaked in a little grout. The grout will soon set, especially when the radiator is warm, and effectively close the leak.

By means of better job control, the California Highway Commission has succeeded in increasing the average strength of concrete in its highways at no additional cost to the state. Pavement laid during 1925 averaged 40 per cent stronger than concrete placed during the previous year and as much as 55 per cent over the average of previous years. More attention to scientific proportioning and a closer watch on mixing and placing has resulted in this worthwhile improvement.

An average well graded concrete mix in the proportion of 1 part cement, 2 parts sand and 4 parts stone with a slump of 6 in. to 7 in. will have a water ratio of 1 and a strength of 2000 lbs. per square inch at 28 days.

New Order Form to Be Used When Buying Reinforcing

A new standard sales contract was adopted by the Concrete Reinforcing Steel Institute at its recent annual meeting, and is being put into use by practically every member of the Institute. This organization, made up of distributors of billet stock bars, accounts for a majority of the reinforcing used in this country. Consequently most contractors will be asked to use the new order form when making this year's purchases. One form of this contract designed for use by a hypothetical Chicago distributor reads as follows:

Uniform Sales Contract Adopted by the Concrete Reinforcing Steel Institute, March 10th, 1926.
THE ABC COMPANY
Chicago, Ill.

..................................Office
To Date
Address Structure
City State Location
Architect

"We propose to furnish the following described materials required for the above structure, in accordance with the following terms, including those printed on the reverse side of this sheet, which upon acceptance by you of this proposal are agreed to and accepted by you:

* * * * * *

"Prices are F.O.B. truck alongside curb at job site.

"TERMS: Net cash 30 days, or ½ of 1% discount if paid in 10 days from date of each invoice, payable in funds par at..................

"We will commence shipment within..................days from date of approval of this quotation by our Home Office, or, where required, from receipt of approval of placing drawings or lists of material by our Office.

"All lists of material or approvals of placing drawings shall be furnished by you to our Office to permit us to complete shipment on or before..................

"Prompt acceptance of this quotation by you and the written approval of our Home Office shall constitute a binding contract.

"Date..................."

This form is made out in duplicate, with one copy for the contractor's own files. On the reverse of the blank are found the following conditions of sale:

"You agree to carefully check material against shipping papers upon unloading at destination. No claims for shortages or for improper, defective or damaged material will be recognized by us unless written notice specifying in detail the nature and extent of the shortage, defect or damage be mailed to our Office within five days from unloading accompanied, in the case of claim for shortage or damage, by original freight bill with a notation on the face thereof by the local agent of the carrier as to the items and quantity short or damaged. When we deliver by truck, all claims for shortages or damaged material must be sent to us on date of delivery.

"Upon receipt by us of the above notice, so substantiated, we agree to replace such shortages and material not up to contract requirements. We will in no case pay or be liable for any claims resulting from use of improper, defective or damaged material, and no claims will be allowed on account of any purchases or returned material, unless authorized in writing by our Home Office.

"Contingencies beyond our reasonable control (including lockouts for reasonable cause) shall be sufficient excuse for any delay in delivery.

"Material shall be at your risk from delivery by us to the carrier at F.O.B. shipping point. Title to material shall remain in us until payment in full by you.

"Your failure to furnish lists of material, to approve placing drawings, or to make payments as provided herein will entitle us to stop shipments without notice to you, to retake possession of any shipments already made, and, upon notice to you, to cancel the unexecuted portion of the contract and to hold you for damages.

"We may at any time decline to make further shipments except on receipt of satisfactory security.

"All material shipped from warehouse shall be invoiced in accordance with our current published schedules of weight, areas, bundles and standard lengths, which shall govern all settlements.

"We assume no responsibility for the design on those jobs where we prepare placing drawings from designs furnished by others.

"No conditions or representations altering, detracting from, or adding to the terms hereof, shall be valid unless printed or written hereon or evidenced in writing from our Home Office and accepted by you."

How Portland Cement Is Used

Recent estimates indicate that the portland cement shipments of 156,724,000 barrels in 1925 were used in approximately the percentages shown in the table below. While it is impossible to gather the necessary data on which to base highly accurate estimates, these figures will serve to indicate the relative importance of the various fields of use.

The high rate of operations in the building industry is reflected in the quantity of cement assigned to "Public and commercial buildings," which classification includes hotels and apartment buildings. The great popularity of concrete roads and streets is seen in the total estimated use in that field, which also makes allowance for cement required in the concrete bases of other types of paving.

Miscellaneous small towns and farm uses account for a surprisingly large percentage of the total. This and the two preceding classifications, all of which represent small sales, represent nearly a third of the total shipments.

Uses	*Per Cent*
Public and commercial buildings	26.0
Houses (exclusive of rural)	8.5
Sidewalks and private driveways (exclusive of rural)	5.5
Small town and farm uses	18.0
Concrete pipe for water, sewers, irrigation and culverts	4.5
Paving and highways	27.5
Railways	5.5
Bridges, river and harbor work, dams and water power projects, storage tanks and reservoirs	3.0
Miscellaneous uses	1.5
	100.0

While the more spectacular concrete structures, such as huge dams and great bridges, individually call for considerable quantities of cement, their number is so small comparatively that they constitute a much less important factor in the total demand for cement than the more commonplace classes of work.

Bureau of Standards Studies Attack of Sea Water on Concrete

The Bureau of Standards is conducting, in co-operation with the Navy Department, a series of resistance tests of different types of concrete masonry, cement and different concrete treatment for the purpose of ascertaining the effect of sea water on those materials.

Mr. P. H. Bates, Chief of the Ceramics Division of the Bureau of Standards, has just returned from the Portsmouth (Va.) Navy Yard, where a large number of concrete piles, which have been stored in salt water for six months, were examined. None of the specimens showed marked effects from the test.

In order to make the test as rigid as possible, more piling has been placed in submerged storage to remain for an even longer period, thereby affording greater information to that which already has been collected.

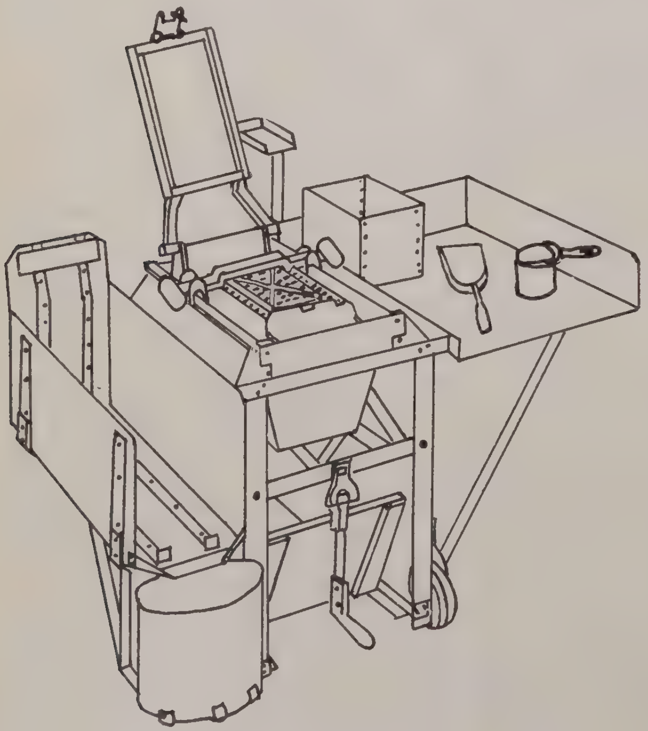
It is reported that metal lath has been 99 per cent simplified, under the provision of the recommendations that became effective on Jan. 1, 1924. In fact, practically the entire industry has now limited itself to the production of the sizes and weights agreed upon at the Hoover meeting of over a year ago. This has meant a saving to the industry of about $2,000,000 that would otherwise have been invested in stock formerly carried.

New Equipment

Machine Perfected for Making English Roof Tile

To meet the demand for equipment to produce the English roof tile, required for the present mode of homes of a British type of architecture, a new machine has been recently announced by the Crawfordsville Machinery Company, 1209 Merchants Bank Building, Indianapolis, Ind. The product is a flat tile that should prove easy and cost little to make, while the specials are so simple that they should give but little more trouble than the tile themselves.

The machine features a cleated pallet that is designed to hold the concrete securely in place during tamping and troweling, thus increasing the speed of the operator and the density of the concrete. Self-lubricating guide rods and a trowel bar slider mechanism speed the operator and reduce his physical effort. The machine is on wheels. The operator pulls it down an aisle of racks as the shelves are filled, thus reducing off-bearing and otherwise moving the product. The trowel bar carrier and the four slide rods are housed with sheet metal to protect the mechanism from pigments and concrete. Adjustments of the machine are easily made. Lubrication is effected by means of the popular Alemite grease gun. This new machine is said to be the fastest hand machine on the market. The same manufacturer supplies machines for making French, Spanish, and Mission tile, together with a cast iron color grinding mill, and other equipment needed in the roof tile plant.



This drawing shows the new English tile machine now manufactured by the Crawfordsville Machinery Company.

New Steel Wall Forms for Large and Small Jobs

A new system of interlocking steel forms, for use in the construction of foundations, bearing walls and partitions for residential and industrial construction, has been recently placed on the market by the Hotchkiss Steel Products Co., Inc., of Binghamton, N. Y. It is said to be very simple and easy to erect, and to be so designed and the parts so built that accurate dimensions are assured. These forms have been tried out on a number of large and small structures before placing them on the market, and are thought to be fully perfected.

Erecting a 7 inch wall on a 20 inch foundation. Forms are being set for the former, but have been stripped from the foundation. Notice the bracing and the scaffold.

The panels are made of 1/8 inch steel plates, heavy steel supporting braces, and heavy steel scaffold arms. Two-by-fours are used to brace the forms by means of the scaffold arms, and boards are used for a scaffold runway. The forms are so constructed and supported that the form assembly is complete with upright supports, interlocking braces and interlocking scaffolding arrangement, and erection is thereby quickly accomplished.

The panels for the side members are standardized with as few units as possible to obtain any usual measurements desired, there being a 2 ft. outside collapsible corner, an angle corner for the inside, which conforms to the width of the wall in construction, a 3 ft. standard panel, and 2 ft., 18 in., and 1 ft. standard panel, 6 ft. and 8 ft. standard adjustable braces and 4 ft. scaffolding arms, which are so constructed that they slip into the locking device of the upright support and onto an outside 2 x 4. This assembly is tightened by means of a nut on a bolt, and no nails are used. There are no loose keys, bolts, or clamps to get lost, and the entire system is said to be very simple and economical to erect.

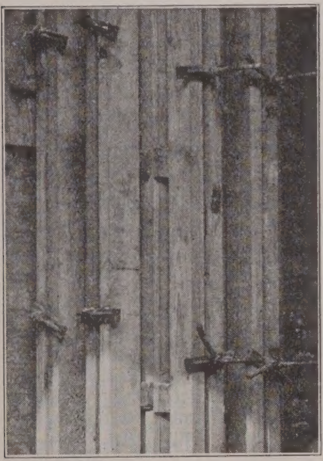
The contractor will naturally ask whether or not the cost of the forms justify the investment—whether they will earn for him a fair return on the expense. If the ordinary house foundation takes three or four men two days to erect with lumber, and the same foundation can be erected in four hours with steel forms, using three men, and if the wastage of lumber used in the single foundation is practically ¼ of the cost of the lumber, and if, in the construction of eight foundations, he finds that he has saved enough in labor and lumber to pay the cost of the steel forms, and if, at the end of that period, he finds the steel forms as good as new, then every succeeding use of those forms will pay him clear profit and thus justify the investment. Steel forms, then, are profitable equipment for the contractor who is doing a good volume of construction, but are more expensive for the man who builds but two or three houses in one year.

With accurately made steel forms the secret of successful use consists in getting the right start. The footing course should be leveled accurately and started an even number of feet below the wall height, and the wall forms will then give the correct wall height to the smallest fraction of an inch.

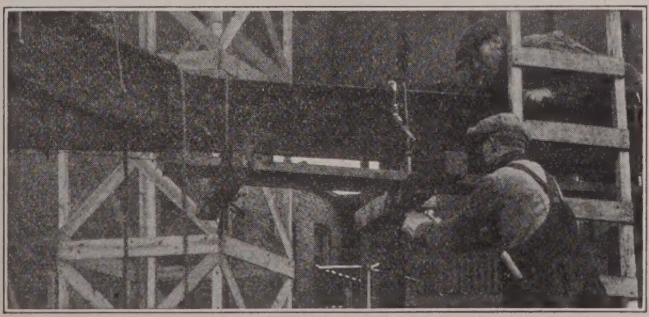
Form Clamp That Eliminates Shores

A new form of "skyhook" that actually suspends soffit forms in such a way as to eliminate the necessity for shoring, and that affords a thirty per cent, or greater, saving on the formwork, has recently been developed and put to work on a number of jobs in the midwest. There is one variety for use on columns and beams on fireproofing work, while another variety is intended for use in forming monolithic walls. The beauty of the clamp is that it actually works according to expectations, state the contractors who have used it. The new state prison at Jackson, Michigan, two theaters and a packing plant in Chicago, a number of railroad and highway bridges, and other structures, both steel and reinforced concrete, are now progressing to completion with their aid. The clamps are made up of spreader rods, or U bolts, clamping cone, jam nut, threaded waler rod, clamp shoe, and wing nut. Spreader rods, or U bolts, and jam nut are left in the concrete, while the rest of the assembly is removed for reuse.

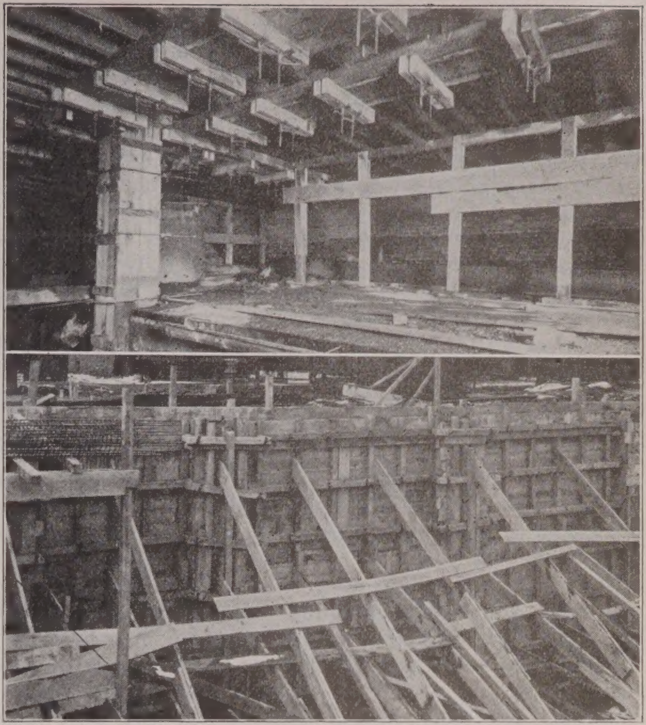
The type using the U bolt system is used on fireproofing on a structural steel job, and holds the soffit forms, which in turn, with the aid of the walers, carry the sideforms of the beam or girder, together with the floor panel forms. This makes possible the elimination of all shoring except that needed to support the center of floor panels in taking care of extreme spans. In this use, the assembly is quite simple. The U bolts, specially fabricated to order, are hung over the steel, with the jam nuts in place on the threaded ends. The cones are next slipped onto the U bolts until stopped by the jam nuts. These cones are long enough to keep the ends of the U bolts several inches inside of the concrete after they are withdrawn. The next step is to insert the threaded waler rod into the cone and screw it up tightly onto the U bolt, the female thread on the waler rod engaging the male thread on the U bolt. Then the soffit forms, through which holes large enough to allow free passage of the waler rods, are slipped into place, held against the base of the cones. Two walers, of two-by-four or three-by-six lumber, are put into position, one on either side of the projecting waler rods, and these in turn are held in place by means of the clamp shoe, bridging the two waler rods, fastened by means of the long-handled wing nut. Tightening the wing nuts clamps the soffit boards between the walers and the cone.



Left — Here is a column form with vertical walers and Williams Form Clamps



Below — Two men are setting forms for fireproofing, which are suspended from the steel by U-bolt clamps



Above—The clamps eliminated shoring on a project where the latter would have found no support and where they would have interfered with the activities of this busy packing plant
Below—Combination foundation and retaining wall on a theater job with the forms held by Williams Form Clamps. The timber braces are helping resist the thrusts received from the street, which might otherwise have given trouble

The side forms are then put into place, where they are carried by the soffit forms and the walers. Thus, when the concrete is placed it will be carried by the forms which are firmly suspended from the steel work, proof against sagging. Floor forms are carried by joists resting on a wood girder carried by the ends of the walers.

When forms are to be stripped, it is an easy matter to remove the wing nuts, with the floor forms held by a few temporary shores, drop the walers, then drop the floor panels, strip beam forms, and then proceed with the columns in the usual manner. After the forms are stripped, it is easy to unscrew the water rods, and then draw out the cones with a special hook furnished for the purpose, or with some other suitable tool, and then patch up the small holes that are left in the concrete. A modified version of this method is used in forming a reinforced concrete skeleton structure, adapting the general scheme to suit the conditions found on that class of work. Instead of using the double cleat described above, for supporting the form assembly, the contractor may use six-by-six inch timbers through which a hole is bored through which to pass each spindle. This affords a firmer support, but costs more, unless the drilling could be done by machine instead of by hand. Columns are clamped by means of spreader rods with the clamp on either end, passing through the column. Vertical walers are utilized.

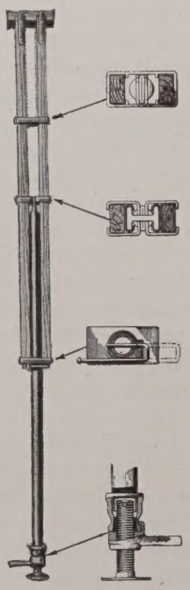
It is on wall work that further advantages are gained by means of the new clamp. Here spreader rods, fabricated to desired length, are used in connection with the standard clamp units. By this means the forms are easily and securely held to line and bulging is impossible. One side of the form is first erected, steel and spreader rods are next placed, and the other side of the form is then erected and clamped in place. No men are required to work inside the forms at any time. Scaffolding is easily and securely tied to the wall with the form clamps. One contractor found that stripping was so easy that 10,000 to 12,000 feet of lumber could be pulled in a half day by four men, and that two men could pull all the cones involved, and patch the holes, in the same length of time. Both horizontal and vertical walers may be used with these form clamps. The clamps, too, may be used for fastening screed boards in bridge construction. It is said that the cones are removed from the forms much more easily than is possible with other clamps, and that the holes in the concrete are much smaller.

These clamps are manufactured and sold by the Williams Form Clamp Company, Inc., 166 W. Jackson Blvd., Chicago, Ill.

A New Adjustable Shore for Concretors

A new adjustable shore called the Dayton, which the manufacturers claim will cut the cost of old 4x4 shoring in half, has been placed on the market by The Dayton Sure Grip & Shore Co., 115 S. Torrence St., Dayton, O.

The shore is composed of 2x4 studs which telescope on 1½ inch pipe. It is adjustable from 8.0 inch to 14.0 inch. Its initial adjustment with the pin as well as the final hair-line adjustment with the extra heavy screw jack on bottom, are positive, and will not permit the shore to creep or settle when load is applied. Final adjustments with the screw jack can be made from 1/16 inch to a full 6 inch, which feature has proven advantageous in basement work, where settlement of mud sills requires the continual adjusting of the shores. The company recommends the shore for a load of 5,000 pounds, although they have been used under loads of 10,000 pounds. Iron sections of the shore are made of specially treated malleable iron, which safeguards against breakage and reduces depreciation to a minimum. There are no loose or detachable parts to become lost either in use or shipping, and no separate tool or jack of any kind is required for its operation. Due to there being no complicated procedure to go through with in their setting, common labor can be used.

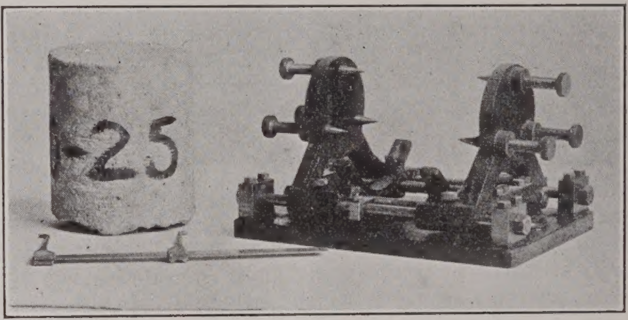


Here is the new shore described on this page.

Complete with wood members the shore weighs 50 pounds, making it easy to handle and easy to erect by one man. Another advantage of this light weight is the proportionately lower freight and trucking charges. Stay bracing, due to the snug method with which the shore is placed under form work, is not required up to 12.0 inches.

An Accurate Device for Measuring Concrete Cores

The testing of concrete cores drilled from finished pavements makes it necessary to have a suitable method by which the height of the specimen can be measured and proper correction made for comparison of the test result secured with those obtained from specimens of the standard sizes. Numerous methods, including measurements by displacement and calipers, have been tried out, but the most satisfactory one consists of a three point device shown in the accompanying photograph.



The Three-Point Measuring Device for Concrete Cores.

The use of this device allows consideration to be given to the irregularities of the top and bottom of the specimen when obtaining the average height. The core rests horizontally on the two circular supports held by a pair of guide rods which are adjustable according to the height of the core. At both ends of the device are the frames holding three screws which are brought in contact with the ends of the core for taking actual measurements. The frames are movable but can be held at convenient positions by means of thumb set screws placed on either end. The core is placed on the supports and one of the frames brought into position to touch the end on the core. It is then clamped and held in place. The other frame is moved into place with respect to the other end of the core and then clamped and its position marked by means of a sliding lug on one of the guides. The three screws in each end of the frame are then manipulated until they just touch the ends of the core. When the core is to be removed, to allow the measurements to be taken, the second mentioned clamp or frame is unclamped and moved back and the core taken out. The frame is then moved forward to its original position in contact with the lug on the guide rod. The distance between the three opposite sets of screw points is then measured and the average of the three readings taken as the height of the core. The average measurements of the repeated operations check very closely when this method is used. The three points measured are equidistant from the center and outside of the core and also from each other.

Mixer Musings

Reported by "Joe"—The Mixer Boss.

It's Up to the Mixer Man

I was visiting a job the other day where this new water-ratio spec. was being used. That's the one, you know, where all the book says is how much water is to be used for each sack of cement and that the concrete has to be just so strong, or stronger. Nothing much at all about voids and fineness—whatyoucallum, nor about how much sand or stone or cement goes into the drum. Just sets a lower limit on cement so's there can't be any skinning, and tells the contractor that the mix must be workable—which the last he'd see to anyway if he had any brains.

The job was just starting, and the foreman was still scratching his head over the new rules, so I figgered there'd be some fun and kind of stuck around for a while. Pretty soon up comes one of these engineer fellows who we knew was working for the architect.

"Getting ready to start mixing?" says he to my friend Bill.

"All set," replied Bill, "but what in the divil am I to put into the mixer?"

"What do you usually use in this kind of work?" asked the slip-stick expert.

"1:2:4, and maybe juggle the sand and stone," was Bill's comeback.

"Well, go ahead and use it," says the level-artist, "but mind you use seven-and-a-half gallons of water to every sack of cement—and no more."

"But that might be pretty stiff," objected Bill. "Can't you shade that a little?"

"Nothing doing!" shot back Leatherlegs. "You can use more cement and water or else adjust your aggregate proportions, whichever suits you best, if you need better workability. It's up to you."

"You mean that I can do whatever I want to with the stuff just so my cement and water are proportioned right, and not too little of either, and the batch is workable?" asked Bill in a kind of surprised voice.

"Exactly!" said the engineer, as he started down the ladder. "The water and cement fixes the strength, and the rest is your lookout."

"Well, I'll be ——!" said Bill, as he started to round up his gang.

Did you ever stop to think why some city work is worse than most state work? Maybe because the city paver has to think about other things than good work. The state engineers think a good job the most important thing of all.

"Why not concretize our railroads, and let them cut down their maintenance costs," a roadbiulder asked me the other day. "They set their ties in concrete in the new depots, so why not all over the lines? It would turn the gandy dancers to other jobs, and sure would turn howling reformers into satisfied stockholders."

Less water and more cement is a better way to get workability than less cement and more water. Try it on your mixer.

Be your own inspector. You will find it cheaper than to let the engineer catch you putting in poor concrete.

A good concrete house costs about the same as a good frame house. You can't beat the first cost of skinned matchbox buildings, but you can figure circles around them when it comes to final costs on good construction.

What's worth more on the job,—a fellow who knows where to find the answer in the handbook, or the bucko who knows how because he did it before.

If you like this, tell your pal. If you don't, tell me.

Joe, the Mixer Boss.

News of the Industry

With the Manufacturers

The Eberling Machines Sales Company announces the removal of its general sales office from the Peoples Gas Building, Chicago, to the main office, 2396 Canal Road, Cleveland, Ohio.

Wallace R. Harris, general sales manager, formerly of Chicago, has made his headquarters at the Cleveland address since May 1, the change being necessitated by the death of Mr. S. P. Day.

Trade Associations

R. M. Simrall has been appointed district engineer of the Kansas City office of the Portland Cement Association. The Kansas City office, located in the Gloyd Building, has charge of association work in western Missouri and Kansas. Mr. Simrall was formerly a field engineer for the association in Kansas, and prior to joining the organization was engaged in various engineering work in Oklahoma and Missouri.

The *Eighth Annual Convention* of the *National Lime Association* will be held at French Lick Springs, Indiana, on June 8-11. Advance reports indicate that the program will be devoted to more intensive activity in all departments. Only two outside speakers are included, and their addresses will probably be on distribution and on the more extensive use of lime in construction.

At the annual meeting of the *American Road Builders Association*, to be held in New York City on May 14, the new officers elected this spring will be installed. This organization is planning for at least 35,000 visitors at the 1927 Good Roads Show and Convention.

The thirtieth annual meeting of the *National Fire Protection Association* will be held on May 10, 11, 12 and 13 at the Hotel Chalfonte-Haddon Hall, in Atlantic City, N. J. Technical papers of interest to those interested in fire protection will be presented during the various sessions, and committee reports on automatic sprinklers, oils, gases, tanks, standpipe and hose systems, and many other items of interest will be presented. A comprehensive plan of entertainment has been announced. The convention is open to all members of the organization and to any others interested in the matters coming before the convention. Information may be secured from the office of the association, 40 Central Street, Boston, Mass.

The Portland Cement Association, formerly located in the Conway Building, Chicago, has just moved to its new home at Dearborn Street and Grand Blvd., Chicago. The main and district office, together with the Structural Materials Research Laboratory, will thus soon be located under the same roof, since the laboratory will probably be moved within the next sixty days. The building, owned and now occupied by the association, was constructed entirely of concrete, the quality of which was controlled wholely by the use of the water-cement ratio strength specification. The interior of the new building affords the visitor an opportunity to see good examples of all sorts of ornamental concrete work. The exterior is of Benedict stone. The organization was moved to the new quarters during the last week of April.

Industrial Literature

"Quick Hardening Concrete," a practical booklet just issued by the North American Cement Corporation, Hagerstown, Maryland, affords data relative to hastening the hardening of concrete by means of an admixture of Cal. The booklet is an application of findings contained in several well-known laboratory bulletins and technologic papers and is written in a semi-scientific manner in such a way that the average contractor can easily apply the scientific principles on his work. According to the booklet Cal accelerates the hardening of concrete by means of its calcium chloride content and through the possibility of the use of a lower water-cement ratio made possible by the fattening effect of the admixture.

"The Koehring Dandie Mixer 7-S" is described in an attractive booklet just received from the Koehring Company, Milwaukee. The interesting mechanical features of the mixer are well illustrated by color halftones, and a set of specifications are offered for the convenience of the contractor who is deciding upon the type of mixer he will purchase for the next job.

"Durability of Cement Drain Tile and Concrete in Alkali Soils," otherwise known as Technologic Paper of the Bureau of Standards, No. 307, dated January 20, 1926, is the latest progress report on the subject of investigations being carried on by the United States Bureau of Standards, Department of Commerce, Washington, D. C. It covers work on the subject up to the end of 1923. According to the report, the resistance of concrete to alkaline waters increases somewhat with density. Low permeability affords some protection: tile made in the packer-head type of machine have been found more resistant than hand-tamped tile, although the former are disintegrated in waters of a high salt concentration. Tar coatings, grout coatings or ferrous sulphate admixtures were found to be ineffective as a protecting medium.

Eighteen C. H. & E. Manufacturing Co., Milwaukee, products are concisely described and illustrated in the later folder by means of photographs and drawings, showing each machine and its actual operation on the job.

Included among them are 7 types of pumps, 5 kinds of saw rigs, 4 hoists, 1 elevator and a mixer.

The Buddy L Concrete Mixer, a toy concrete mixer that actually mixes concrete, is being produced by the Moline Pressed Steel Co. of East Moline, Ill., and is described in a special folder that also describes the other toy construction equipment manufactured by the same concern. The toy mixer appears to be an excellent medium of instruction for the younger generation and should aid contractors in bringing up that boy who will some day step into his dad's contracting firm. Since the toy will mix concrete just like a real mixer, it will teach the youngster the bad effects of poor materials, wrong proportioning, and the other things that sometimes lead to trouble on the job. The toy mixer is also proving of value in vocational training schools where demonstration of mixing and proportioning would prove impractical with a larger machine. The same concern manufactures a miniature locomotive crane and clamshell bucket, a piledriver, a motor truck, and similar toys. The interesting booklet describing these products, written for the boy himself, should be in the hands of every contractor who has a boy from 3 to 12 years old.

An elaborate eight-page broadside, 11x14 in., has been prepared and distributed by Joseph T. Ryerson & Son, Inc., of Chicago. Preceded by a short message from Joseph T. Ryerson, president, four full pages of photographs of the company's six steel plants, their products and handling well illustrate the enormity of the business.

Further insuring better concrete under average field conditions by the use of admixtures is advocated by the Celite Products Co., Los Angeles, Calif., in its booklet "3B." Numerous photographs of jobs on which Celite has ben employed, abetted by an interesting story of Celite's benefits, tell a complete story. Copies are available to concrete construction men.

A recommended outline for building codes, contained in the report of the Building Code Committee, Department of Commerce, is published in booklet form under the title "Recommended Practice for Arrangement of Building Codes," the fifth of a series prepared by a group of engineers several years ago appointed by Secretary Hoover to draw up more economical regulations for states and cities.

Composed of 19 chapters, this publication deals concisely with such subjects as materials, loads and stresses, construction and precautions during building operations.

Wherein We Correct an Error

In a publication review in our last issue we stated that the capacity of the tile machine manufactured by the Eberling Machines Sales Company, Cleveland, was 5,000 four inch tile a day. Since the production of the new machine far exceeds this figure we hasten to correct the impression given to our readers and state that the machine will produce 5,000 *eight inch tile* a day, or 10,000 *four inch tile* in the same time.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit.

American Concrete Pipe Association; M. W. Loving, Secretary, 111 West Washington St., Chicago.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 West Thirty-ninth St., New York City.

American Road Builders' Association; Wm. H. Connell, President, Miss E. A. Birchland, Secretary, 29 W. 39th St., New York City. Annual meeting, New York City, May 14.

American Society for Testing Materials, C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa. Annual meeting, June 21-25, Atlantic City, N. J.

Associated General Contractors of America; D. H. Sawyer Secretary, 1038 Munsey Bldg., Washington, D. C.

Associated Metal Lath Manufacturers; 123 West Madison St., Chicago; Wharton Clay, Commissioner.

Building Officials Conference; Frank Burton, President, J. F. Downey, City Hall, Cambridge, Mass., Secretary.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, 160 North La Salle St., Chicago.

Concrete Products Association; John E. Powers, President, Sterling, Ill.; D. R. Collins, Secretary, Milwaukee, Wis.

Mid-West Concrete Products Association; D. R. Donlen, Secretary-Treasurer, 4340 Marcy St., Omaha, Neb.

National Association of Building Trades Employers; A. E. Coleman, President, 37th St. & Stewart Ave., Chicago. A. W. Dickson, Executive Secretary, 214 Electric Bldg., Cleveland, Ohio.

National Association of Builders' Exchanges; William F. Chew, Baltimore, President; Earl F. Stokes, Secretary, 15 East Fayette St., Baltimore, Md.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 East Twenty-second St., New York City.

The National Lime Association; Burton A. Ford, Secretary, 918 G. Street, N. W., Washington, D. C. Eighth annual convention, French Lick Springs, Ind., June 8-11.

National Slag Association; H. J. Love, Secretary-Treasurer, 933 Leader-News Building, Cleveland, Ohio.

National Sand and Gravel Association, V. P. Ahearn, Executive Secretary, 903 Munsey Bldg., Washington, D. C.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

Portland Cement Association; William M. Kinney, General Manager, 33 West Grand Ave., Chicago.

Wisconsin Concrete Products Association; A. P. Kuranz, Secretary-Treasurer, 425 E. Water St., Milwaukee.